

# FLIGHT

&  
The AIRCRAFT  
ENGINEER.

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport.  
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## Flight

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**NOTICE.**—Owing to Christmas Day and Boxing Day falling on Tuesday and Wednesday in Christmas week, it is necessary that all copy, Editorial and Advertisement, for the issue of December 27th, should reach "FLIGHT" Office not later than the morning of December 20th.

## EDITORIAL COMMENT.

"Newspapers are an essential part of our war organisation."—  
(Sir Auckland Geddes, Minister of National Service).



SINCE we wrote last week on the subject of the strike among the sheet metal workers in the Midlands, there does not seem to have been any improvement in the outlook. What all the trouble is about we are really at a loss to appreciate. So far as it is possible to discern, the position is that the men are out for totally vexatious causes—causes which fall very far short of justification for holding up essential production at a time like the present. The difficulty, briefly, appears to have arisen in connection with certain demands made by the Sheet Metal Workers' Society, which the employers, while they considered the demands to be unreasonable, nevertheless offered to submit to the arbitration of the Chief Industrial Commissioner as provided by an addition to an agreement entered into between the two parties on the 30th October. Accordingly, the points in dispute were referred to Mr. Murray, of the Chief Commissioner's Department, who had drawn up the agreement in question. He decided against the Society, and Sir George Askwith who was present confirmed the decision. The consequence was that the Society, which did not like the interpretation of

#### Another Strike of Aeroplane Workers.

the agreement to which it had set its hand, called upon its members to cease work—and the production of essential aircraft is now held up by its action.

Mr. Marston's letter to the *Times*, which we quoted in full last week, has called forth a reply from the joint Secretaries of the Society, in which he is accused of all sorts of evasions and exaggerations, of which he has completely disposed in an answering letter. For our own part, we are not particularly concerned with the *tu quoque* part of the business. What, however, we are concerned with is the deplorable effect of the want of good faith—for it seems to us to merit the description—manifested by the representatives of the workers. It does not seem to appeal to the executive of the Society that an agreement is an agreement at any time. In a period of profound peace the honourable man stands by his pledged word, and in times of crisis like the present the patriotic person, man or woman, manual or brain worker, carries on and settles differences without appealing to the ultimate course of delaying production, with its inevitable corollary of lost lives. According to the statement of the Society as communicated to the *Times*, dilution of labour, which is one of the points of the dispute, apparently, has taken place in the sheet metal trade, "but not to the extent and in the manner which Mr. Marston and people who think like him would desire; these people are not out for dilution to help the country, but to obtain cheap labour, contrary to the intention of the Munitions Act!" That seems to be the sum total of the indictment against the employers, and we must say that to us it looks a bit thin.

Again, according to the letter of the Society, 20 per cent. of the sheet metal workers of the Midlands are in the fighting services and the point is made that if more are taken aircraft, the Admiralty, and the supplies of munitions generally will be seriously affected. In the first place, 20 per cent. does not

seem to us to be a very high figure. We are strongly inclined to think, in the absence of any very definite statistics, that it is about as low as any trade in the country can show, while as to the point about the retarding of munitions output, we seriously put it that the other eighty per cent. would be better in the Army than loafing about the streets of Birmingham, Coventry and Wolverhampton.

Another point which the Society strives to make is that all the men affected are skilled workers, whose places could not in any case be taken by women. The special correspondent of the *Daily Mail*, who has been investigating the strike on the spot, says:—

"On a trivial point, when the urgency of our air activities is borne in mind, over 4,000 members of the Sheet Metal Workers' Union are idle, and their shops in Wolverhampton, Coventry, and Birmingham are closed down. The strike did not originate over aeroplane work at all. The metal workers are really tinmen. They work 54 hours a week for a minimum wage of 55s. 6d. Their main employment is soldering kettles, pots, pans, and ammunition boxes.

"The best of them have been shifted from their old, easy-going jobs to the highly-important work of radiator making, for which they are paid £5 per week. The tinman section, having "downed tools," have carried off the aeroplane section, and thus it is that our aeroplanes are still delayed. This is all the more aggravating when it is remembered that the work of these men could easily be done by women. But it is one of the Medean laws of the Metal Workers' Union that there shall be no dilution in their trade, war or no war.

"The union is also against recruiting in any form, and I am told by the head of one firm engaged in aeroplane manufacture that the men refuse to speed up, but just dawdle along as if to-morrow will do."

Has the Society, we wonder, an effective reply to this indictment? It may be that there is a reply, but if so it has not been formulated yet and at the time of writing the strike is still in progress. As we said last week, these people are simply asking for trouble and almost appear to be begging the Government to take strong action and to militarise essential industries. This course has been taken in more than one of the belligerent countries and it will have to come here if labour is unreasonable. We have got to win the war, some way and somehow, and if we cannot win it without militarising our industries, then we must face the unpleasant alternative.

#### A Wicked Slander.

To the temperance orator—even the fanatic—we have no rooted objection on his own account, so long as he confines his arguments to the demonstrable truth. He has a right to prove his case in the way that seems best to him, if in the process he refrains from slandering those who do not happen to see eye to eye with him. It is a deplorable fact, but one that must be admitted, that he need never be short of valid argument or reason for inveighing against the abuse of intoxicating drink without descending to innuendo or adorning his tale by absolute falsehood. Here and there, however, one comes across the type of temperance advocate which is not content to keep his case within the bounds of reason or even of simple truth. Carried away by fanaticism, he indulges in all sorts of wild diatribes which too often have not the slightest foundation in fact. Of this type the Rev. B. E. Horlick—whoever the reverend gentleman may be—appears to be an example, for we find him addressing a meeting of the Tiverton and District Free Church Council and telling his audience in the course of his doubtless eloquent peroration that he had been told by a flying officer that "nine-tenths of the accidents in his air-camp were due to men getting fuddled overnight."

Now, it is possible that the Rev. Horlick had in fact been told that, but it certainly seems to us he ought to have taken some steps to ascertain that he had not had his leg pulled before indulging in an indiscriminate charge of drunkenness against our flying men. Alternatively, if he had not been the victim of leg-pulling and if the information had been passed on to him in apparent good faith, did he go out of his way to confirm the truth of the statement before letting himself loose? We do not doubt for a moment that the flying service contains officers and men who are rabid teetotallers and to whom the taking of a single drink is enough to lead to the belief that the drinker is of necessity a drunkard. Was it from a person of this type that his information was gathered? Assuming that it was, then we say it is absolutely valueless as evidence, and the reverend accuser ought to know better than to bring so sweeping a charge on the mere *ipse dixit* of a fellow fanatic. But however the information was gathered or whatever its source, we have no hesitation in saying that it is absolutely false. To begin with, flying is a pursuit which demands a clear head and unshaken nerves, which do not go together with habits of drinking to excess. Again, what would be done with a commanding officer who countenanced drunkenness in his command? He would be deservedly relieved of his command in a week and would never be employed again in a responsible position. However, so far as the charge itself is concerned, it is scarcely worth answering in detail, so absolutely groundless and puerile is it. In fact, we should scarcely have thought it worth while to give the Rev. Horlick the advertisement we have done had our attention not been specifically called to the cruel slander of which he is the author. It is pointed out to us that a great deal of needless pain has been inflicted upon the parents and friends of those young flying officers who have given their lives for the country while under instruction—an aspect of the matter that possibly will not appeal to fanatics of the Horlick type. Under all the circumstances, we trust the authorities will not allow the matter to rest where it is. More than one person has been prosecuted and severely punished for making statements not nearly as mischievous as the one under discussion, and it is to be hoped that proceedings will be instituted, and that the Rev. Horlick will be called upon to give the precise source of his information, together with the name of the officer who, he alleges, made a wickedly slanderous statement upon which the general accusation was based. Nothing less than this will meet the case—and it is the least that is due to our flying men.

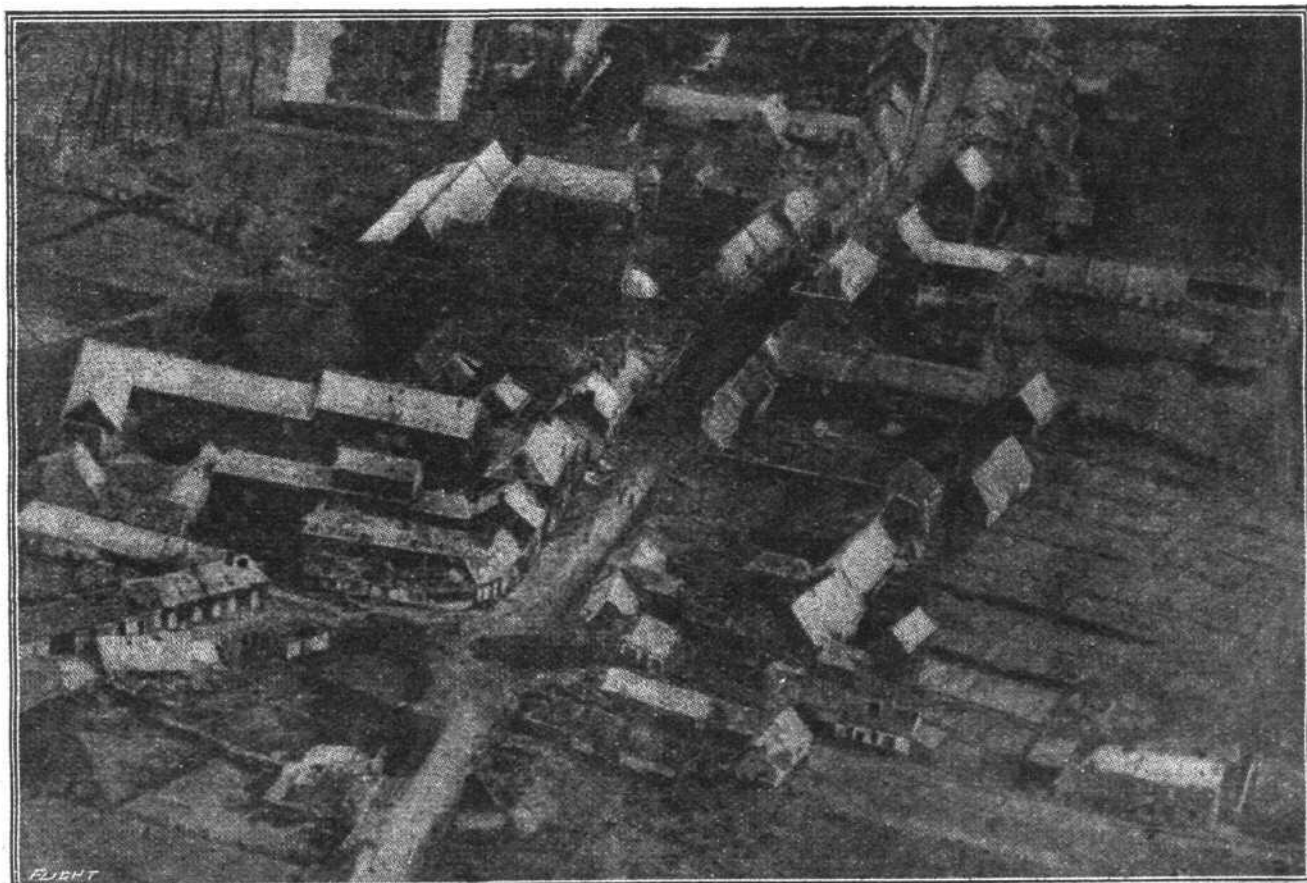
#### Last Week's Air Raid.

In several ways the German air raid on London on Wednesday of last week possessed novel features. It is the first time that an organised raid in strength has been made in the early hours of the morning, just before daybreak. Moreover, it had an unexpected feature in that it occurred at a time which left a very small margin of safety for the raiders, who were faced with the problem of recrossing the Belgian coastline in daylight. Another feature was that a new tactical device was adopted by sending over two feint raids with the obvious purpose of diverting attention from the main attempt on London. In spite of all the elements favourable to the enemy, including poor visibility from the ground, the raid met with very little success, no more than five or





**THE RECAPTURE OF NESLE.**—On March 19th, 1917, the British cavalry entered the small town of Nesle, which had until then been occupied by the enemy. The above photograph was taken from an aeroplane at a height of 700 ft., and shows the historical event in bird's-eye view.—(*"La Guerre Aérienne."*)



**ANOTHER PHOTOGRAPH OF ONE OF THE SUBURBS OF NESLE.**—This photograph was secured from the aeroplane of Adjutant Larrouil, who was the first pilot to land in the recaptured territory.—(*"La Guerre Aérienne."*)

six machines at most being able to get through the barrage, while two fell victims to our anti-aircraft gunfire.

On the whole, the defence may fairly be said to have scored a success, for although a number of bombs were dropped—mostly of the incendiary type—very little material damage was caused and the casualty bill was fortunately light. The principal moral to be deduced from the raid is that the enemy has by no means abandoned his intention of attacking the heart of the Empire on all and every occasion on which he may find it practicable. On the contrary, we may be very certain that these raids will progressively increase in number and intensity until we have taught the Hun that the game is not worth the candle. There is only one way in which this can be done and that is, as we have so constantly insisted, by taking the war into Germany. We have been told, time and again, that this is the intention—that we are going to “give the Germans Hell”—! But the trouble is, from the point of view of the British public, that all these things still lie in the future—we have not “given the Germans Hell” or anything like it. True, the weather conditions of late have not been favourable for long-distance raiding, but against that we have seen that the enemy is alert and quick to take the fullest advantage of a favourable change in those conditions. It must be admitted, too, that our aircraft have carried out one or two detached enterprises on the other side of the German frontier, but on nothing like a sufficiently large scale to prove deterrent. Why is this?

The answer is that, in the first place, the needs of the armies in the field are, and must remain, a first charge on our aircraft resources. It is only after they have been filled to the last machine and the last bomb that we can have anything left over for taking the war into the enemy's country. And that brings us to another aspect of the matter. How can we expect to see our Air Service expand to the dimensions which will place a sufficient number of machines at the disposal of the authorities to “give the Germans Hell” while our aircraft workers cultivate the habit of going on strike on every futile pretext? We put it very strongly to all concerned that if we are not to see an increase in the number of hostile raids on our towns, there must be no more of these vexatious stoppages of work. Actually and morally, some of the deaths of the unfortunate victims of these raids may well lie at the doors of those responsible for holding up the production of the machines we want for carrying the war into Germany. In saying this we make no attempt to apportion the measure of blame due to either or both parties to these deplorable industrial disputes. All we are concerned with is

their effect on production, and we trust these remarks of ours will be taken to heart.

### The Plight of Our Prisoners of War.

A correspondent writes us the following letter:—

“In a letter from my brother, Lieut. Littlewood, R.F.C., a prisoner at Holyminden, Germany, the following paragraph occurs:—

“We have “adopted” a Flying Corps youngster who has been a prisoner only a month or so. In other words, we feed him as his parcels have not commenced to arrive. . . . We often have some of the new people in to meals and it does one good to see them eat. Will you please send Lady Henderson the sum of . . . for me, and ask her to send parcels to that amount to the Senior British Officer, Karlsruhe, for newly taken flying officers in Karlsruhe. Practically all flying officers go there. Is there a fund in England to deal with this? If not, why not drop a suggestion to the Editor of FLIGHT? It really is terrible to go short of food.”

It seems to us that this letter affords yet another opportunity for drawing attention to the magnificent work that is being done by the R.F.C. Aid Committee—which was begun in September, 1915, and has been continued unremittingly ever since. From the headquarters at Surrey House a parcel of food is sent off directly a new prisoner's address reaches the office, and if the next-of-kin are abroad the parcels are continued every week until other instructions are received. Apart from the parcels forwarded at the expense of the Committee's funds, all parcels sent to officers or men of the R.F.C. interned in enemy countries pass through the Committee in conformity with the regulations governing the despatch of parcels to prisoners of war. It will thus be seen that the interests of our unfortunate prisoners are well looked after by a thoroughly responsible Committee, which is doing its best under the most difficult circumstances to see that none of our officers or men, who have had the ill-luck to fall into the hands of an inhuman enemy, shall go short of the necessities of life. Now, all this good work necessarily costs money and the expense is an ever-growing one between the higher cost of commodities and the increasing number of prisoners. Particularly at this season of the year it is up to all who are interested in our flying services to come to the support of the Committee either by donations of money or of comforts for the use of the prisoners. Anything sent to Lady Henderson, at Surrey House, Surrey Street, W.C., will be received with gratitude on behalf of those suffering from the ill-fortune of war.

### Honour for the Director - General of Military Aeronautics.

It is announced in the *London Gazette* of December 7th that His Majesty the King has approved of the promotion to Brevet Colonel of Major and Brevet Lieut.-Col. (temporary Major-General) John Maitland Salmond, C.M.G., D.S.O., Royal Lancaster Regiment, Director-General of Military Aeronautics, in recognition of his distinguished services.

### Seniority of R.F.C. Observers.

In December Army Orders it is announced that the following will be substituted for the third paragraph of Army Order 403 of 1916:—

“It has also been decided that officers so appointed shall take their places in the list of flying officers from the date on which they embark for overseas for duty in the case of those

who have undergone an observers' course of instruction in England, or from the date of joining the R.F.C. in the field in the case of those who undergo their course in the field. This will give them seniority in the corps as flying officers, but they will not be entitled to receive pay as flying officers (observers) prior to the date of qualification.”

### Return Wire Rope Reels.

We are requested by the Controller of Aeronautical Supplies to publish the following:—

“In view of the shortage of timber, all aeroplane contractors who have on their premises reels on which flexible steel wire rope has been supplied are requested to return same to the wire rope manufacturers. All reels delivered in future should be returned to the wire rope makers immediately it is possible to do so, and should be kept in good condition so as to allow of re-use.”



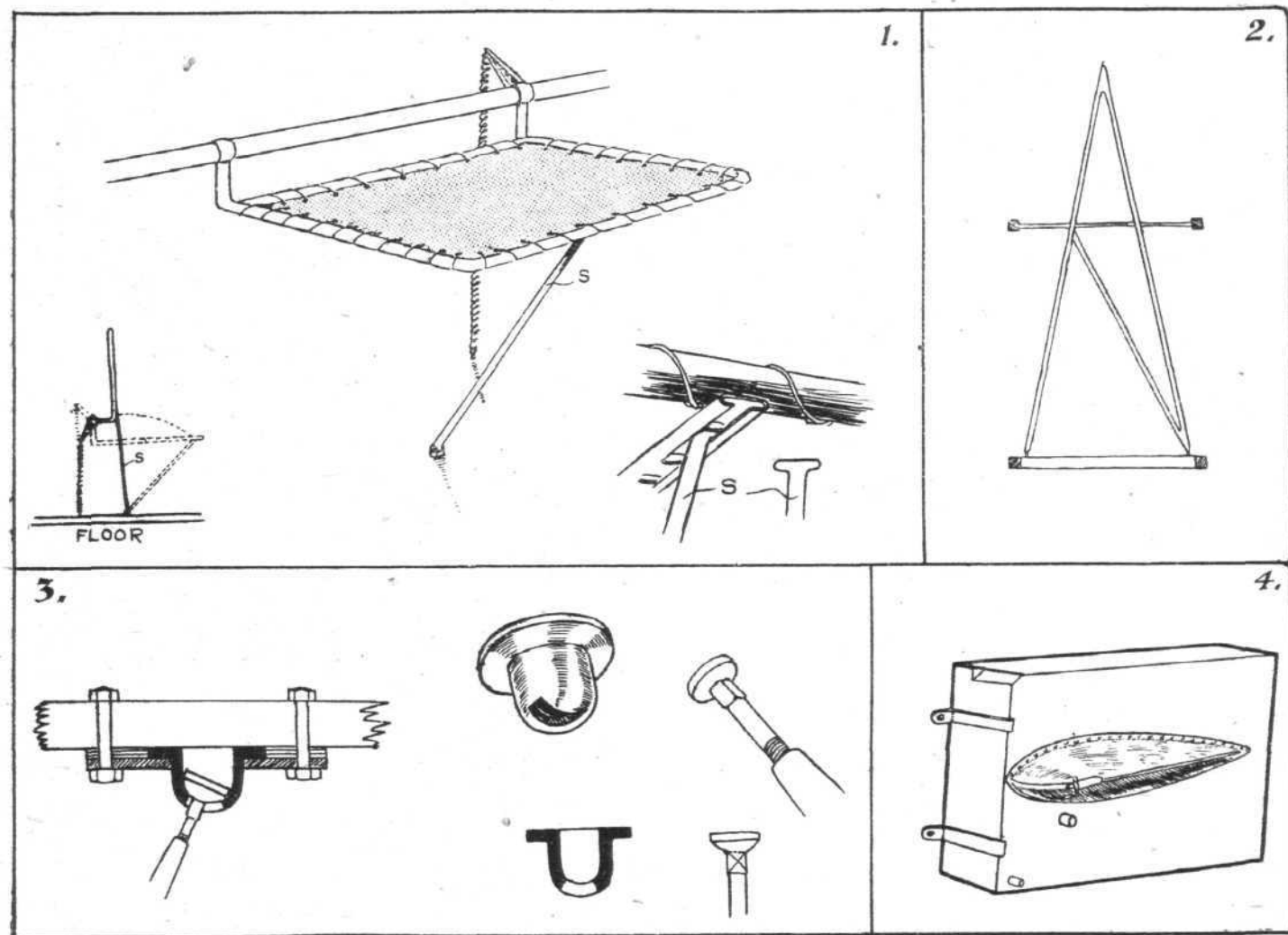
## THE AGO—AN INTERESTING ENEMY AEROPLANE.

A MOVE in the right direction has undoubtedly been made by the Air Ministry, in collecting a number of enemy aeroplanes, aeroplane parts, and engines at a London dépôt, and to grant facilities to aeroplane designers and representatives of responsible firms to view this collection. The query might be raised why the collection has not been thrown open to the public, but the various exhibits are of such a nature that they appeal more particularly to the trained engineer than to the general public, arranged as they are to show every constructional detail of the different machines. For the purpose for which the collection is intended the machines and parts are

propose to give, in this issue, a complete list of the exhibits, since, in any case, these change from time to time, but we hope later on to be able to publish sketches and descriptions of other machines.

For the present we will confine ourselves to dealing with one captured enemy aeroplane—the Ago—which, thanks to the courtesy of the Air Board officials, our representatives have had the opportunity of examining in detail.

The first impression one receives on being suddenly confronted with the captured Ago biplane is apt to be one in which surprise mingles with curiosity. As regards its general lines, the Ago is of a strikingly

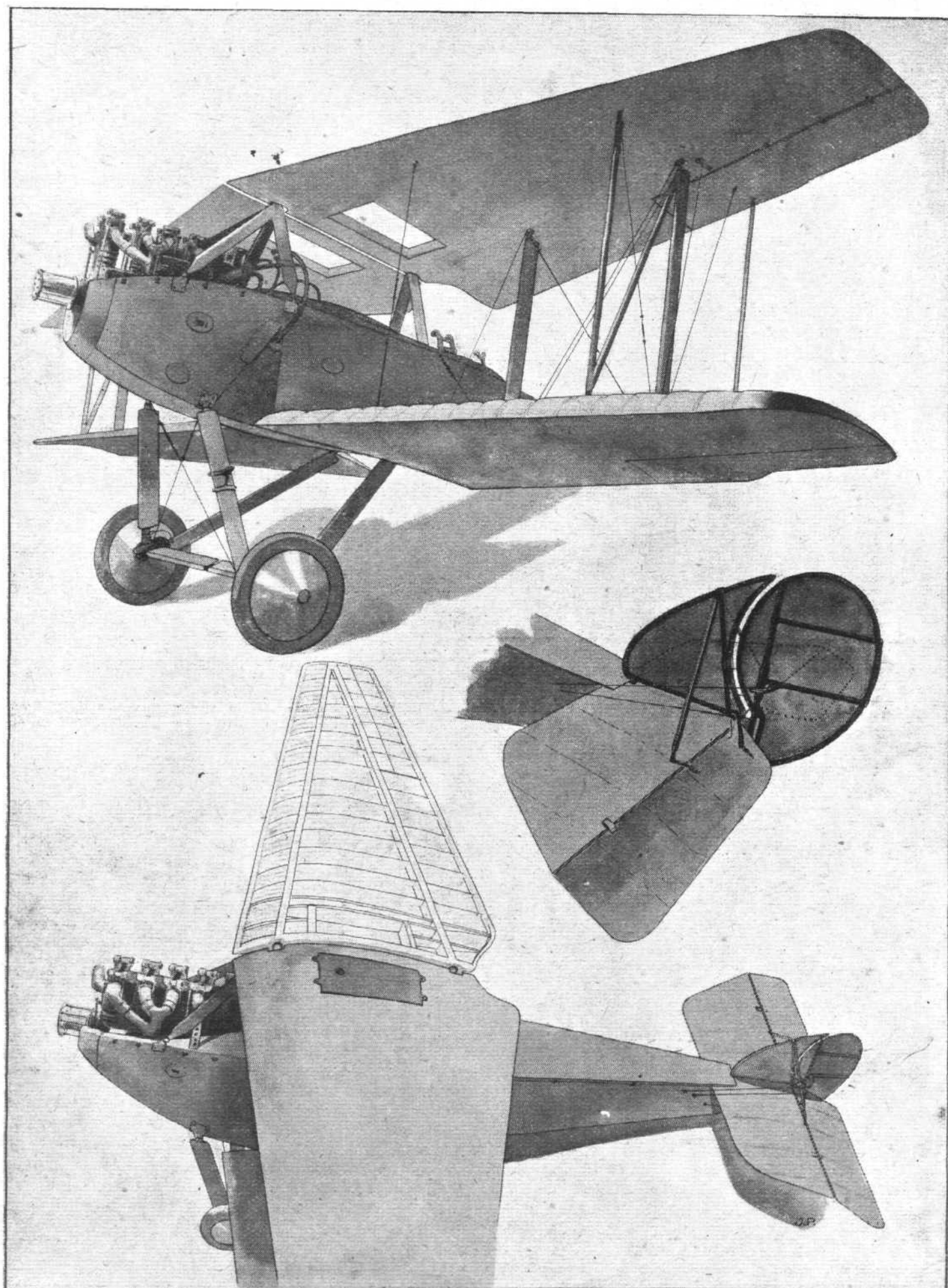


**THE AGO BIPLANE.**—Some constructional details. 1. The gunner's seat. 2. The rear cabane. 3. A cable attachment extensively employed on the Ago. The cup-shaped socket is machined out of the solid, and has a slot through which passes the shank of the strainer. Three-ply packing is placed between the plate of the fitting and the base so as to make up the thickness of the socket. 4. The petrol service tank lying on its side on the floor. When in place on the machine it is carried in the opening in the upper wing to the left of the cabane.

most admirably arranged. Thus, in the case of complete machines, these are shown with one side stripped, up to the centre line of the *fuselage*. The other side is left uncovered. In this way it is possible to obtain on the one side an impression of the general arrangement of the machine, while, by merely walking over to the other side, one can inspect, at leisure, every spar, strut, wire and fitting. Great care and foresight has been shown, also, in the manner in which various parts, such as spars, &c., have been cut through in places, to allow of inspecting sections and internal construction. In this manner there are practically no component parts of which the general design and detail construction are not instantly clear from a very brief inspection. We do not

unusual appearance, mainly, no doubt, due to the fact that its wings are tapered very pronouncedly from root to tip. This is very unusual in any modern machine, and when it is suddenly met with in a German machine of comparatively recent date—from various marks on the machine one gathers the impression that it was built certainly no longer ago than the first months of this year—the question that first comes to mind is naturally enough related to the *raison d'être* of this unusual design.

In the first place, it is obvious that whatever it was the designer was aiming at, he was prepared to go to considerable trouble to obtain it, since the construction of such tapered wings as those of this Ago are not by any means an attractive proposition



THE AGO BIPLANE.—Some general views. Top: three-quarter front view. The openings in the top plane for the radiator and petrol service tank should be noted. Bottom: view from above, showing in diagrammatic form the construction of top plane. Inset: the tail planes.. (See page 1301.)



commercially, entailing, as it does, the separate construction of half the ribs, no two of which are alike from root to tip in one wing. Also, as the spars converge to a point at the tip, they intersect the ribs at varying distances from root to tip, which again means extra work in manufacture. As for the spars themselves, they also taper from root to tip, again more trouble and expense.

What, then, are the reasons which have led a designer to sacrifice so much from a manufacturing point of view, in order to obtain his end? A walk round the machine soon furnishes the reply to the question. When standing in front of the machine one is at once struck by the peculiar bracing of the front spar. Instead of the usual interplane strut there is on the Ago only a single solid wire running from the front lower spar to the front top spar, while no lift or landing cables of any sort are employed between the two front spars.

This feature, then, will probably be found to contain the solution of the peculiar design. By doing away with the front bracing, a much freer field of firing is obtained; and there can be little doubt that this was the object for which the designer was striving.

Owing to the backward slope of the leading edge of the planes, the outer inter-plane struts are farther back than they would be in a machine with straight wings, and also owing to the taper, closer together and therefore obstructing the field to a smaller extent. The narrower chord near the tip will result in a smaller travel of the centre of pressure, hence possibly the twist on the wings may become less, and the absence of front bracing be a less serious defect than one is inclined to imagine at first.

When we say absence of front bracing, this is not quite correct, since, as already indicated, a single solid wire runs from top to bottom front spar. As is well known, in biplanes, with top and bottom planes of the same area, and with the conventional spacing of gap about equal to chord, the top plane carries about 30 per cent. more load than the bottom one, or roughly,  $\frac{1}{3}$  and  $\frac{2}{3}$  respectively. By running a wire from the top to the bottom front spar, the latter is therefore made to carry a certain share of the top spar's load, thus relieving, to a certain extent, the enormous bending moment that must be present on a comparatively heavily loaded machine, whose front spars have a distance of some 13 ft. 6 in. between supports.

So much for the general design of the Ago. As regards the construction there is much detail work that is interesting and unusual. The *fuselage*, which is, as in the majority of German aeroplanes, of very roomy proportions, as regards occupants' accommodation, is covered with fabric except the front around the engine, which is covered in with three-ply. The floor of the *fuselage* is of three-ply from the stern to the gunner's (rear) cockpit. From there to the nose the floor is three-ply, covered with aluminium. In section, the *fuselage* is rectangular, a light and comparatively flat structure forming a turtle back over the top of the main *fuselage* framework. This turtle back is built up as a separate unit, and is easily detachable by means of a neat and very simple clip. In case of severe stresses being put on the fuselage, it is therefore an easy matter to detach the top covering and examine and adjust the internal bracing.

The four *longerons*, which are of square section,

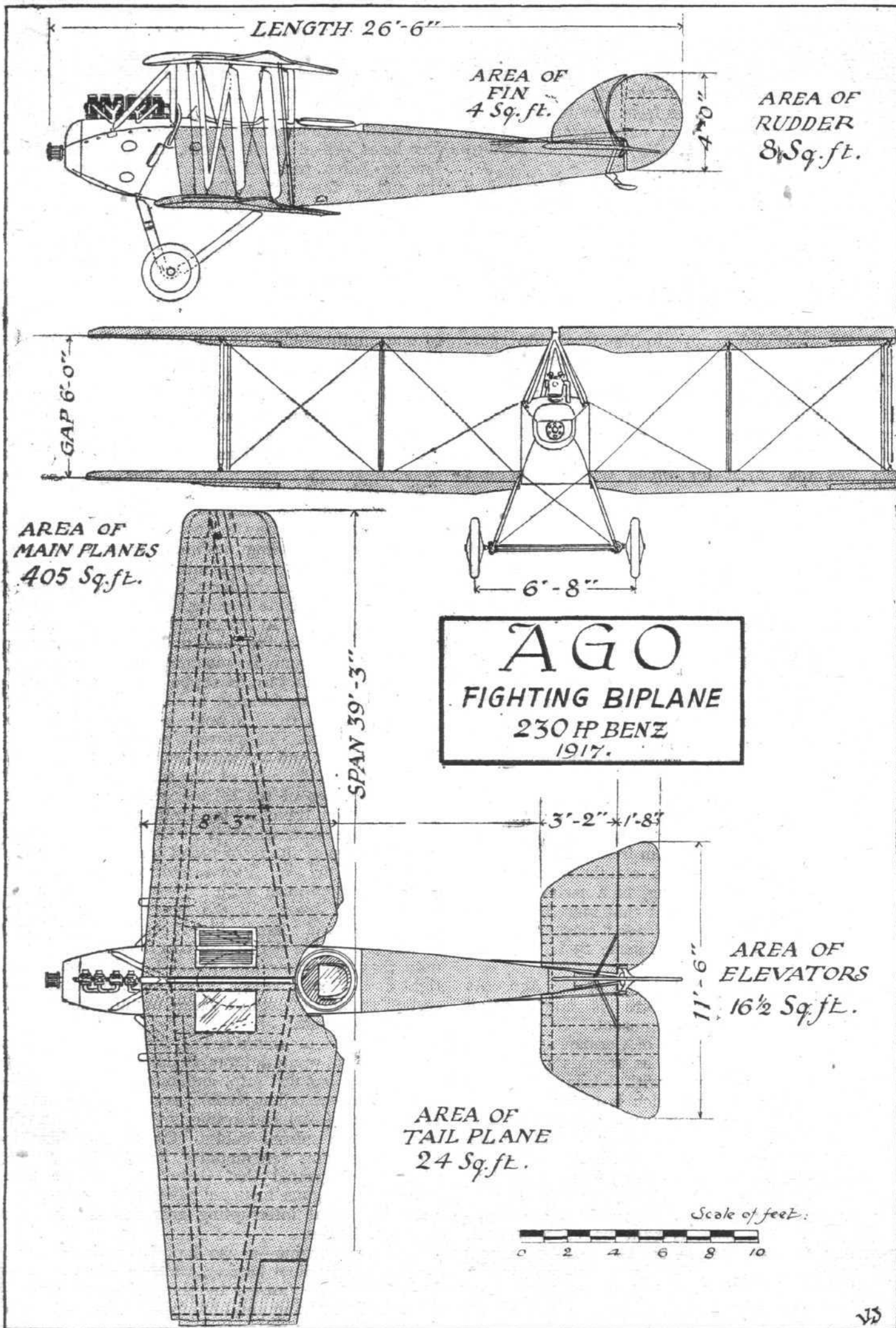
are pine, from the rear cockpit to the stern, while in front they are made of ash. The struts are in the form of steel tubes, and the solid wire bracing is attached to the struts in the manner shown in one of the accompanying sketches. A small socket, apparently machined out of the solid steel bar, has holes drilled in its edges, through which the bracing wires pass. This socket is slipped over the end of the tube, which has small dents in its end to give more room for the loop of the wire, and the socket, with its strut, is secured to the *longeron* by a bolt passing through it, with the nut and a spring washer inside the socket, as shown in section in one of our sketches. Except for the fact that the *longerons* are pierced by two holes—the horizontal and vertical *fuselage* struts are staggered in relation to one another—close to one another, this arrangement appears to be very neat, and certainly takes up very little space.

In front, the *fuselage* bracing is in the form of diagonal steel tubes, no wires being employed. The rear cockpit is occupied by the machine gunner, who is seated on a small seat built up of a framework of steel tubing, over which is stretched canvas. This seat is so hinged and sprung that immediately the gunner stands up the seat springs into a vertical position out of his way in case he wishes to do his shooting in a standing position. When horizontal, the seat is supported by a slanting steel tube, pivoted at its lower end to the floor, and having its upper end running in a steel guide, bolted to the under side of the seat. The principle will be better understood by reference to one of the accompanying sketches. The gun is mounted on a swivelling bracket, which, in turn, is supported on a rotatable gun ring of wood, forming, in effect, a turntable, by means of which the gun may be traversed in any desired direction. To prevent damaging the nose of the machine and the propeller, a stop is provided for the gun in the form of two small frames clipped to the rear legs of the cabane, which prevents the gun barrel from travelling too far inboard.

The pilot's seat, which is in the front cockpit, is placed on top of the main petrol tank resting on the floor of the *fuselage*. A service petrol tank is carried in and mounted flush with the top plane just to the left of the cabane. In the corresponding opening in the upper right hand wing, is carried the radiator, and in connection with these two it is interesting to note that the water and petrol is led through the right and left cabane legs respectively, thus saving a certain amount of piping, which would otherwise be exposed to the air.

The controls are, more or less, of the usual German type, with a vertical lever terminating at the top in a double handled grip, and mounted—via a universal joint—on a longitudinal rocking shaft, having at its other (rear) end crank levers for the attachment of the *aileron* cables. On the machine in question, no guns were mounted, but from the various fittings it appeared that there were at one time two machine guns mounted above the engine, and with the usual interrupting gear for clearing the propeller blades.

The large engine—a 230 h.p. Benz—is mounted on two longitudinal bearers, which are in turn supported from the *fuselage* by three direct supports—at the rear a sloping panel of ply-wood, in the middle by tubes sloping up from the junction of the rear panel to the lower *longerons*, and at the front by



A CAPTURED AGO BIPLANE.—Plan, side and front elevations to scale.



another panel of ply-wood, this a vertical one. In addition to these direct supports, the engine mounting is further braced by tubes to the upper *longerons*, and by diagonal tubes from top to bottom *longerons*. It has already been mentioned that the main petrol tank is placed on the floor of the pilot's cockpit, while the petrol service tank is mounted in an opening in the top plane. The oil tank, which is comparatively small, is carried under the engine housing on the right-hand side of the crank chamber. The propeller, which was not in place on the machine inspected, probably had a "spinner," or hemispherical nose-piece over the boss, as this would appear to go well with the nose of the *fuselage*, which is of rounded section at this point.

The main planes are, as already indicated, tapered from root to tip to a very marked extent, the trailing edge sloping considerably more than the leading edge. Successive ribs are of different depth, as well as chord, owing to the fact that the spars, in addition to their convergence, are of varying depth from root to tip. Whether, however, the ribs change progressively in such a manner that all are of actually the same section, but reduced geometrically, or whether they alter in shape as well as in size has not yet been ascertained, but judging from the way in which the spars taper it would appear that the end ribs are not of quite the same section as the inner ones.

Constructionally, the ribs are of the usual I section, with webs which appear to be made of poplar, and with flanges of ash. In between the spars the webs are lightened by cutting out in the usual way. The leading edge is of pine of U, or, more correctly speaking, of a rounded V section between ribs, but left solid where the ribs are attached to it. The trailing edge is a thin lath about 1 in. wide by about  $\frac{3}{16}$  in. thick.

The main wing spars are of an interesting construction, and their section is shown in the accompanying sketches. The two flanges are glued to thin webs (about 5 mm.), the whole being wrapped in fabric. No tacks or screws are employed for securing the webs to the flanges, the glueing and wrapping being apparently relied upon to be sufficient for the purpose. At the points where occur the ribs a three-ply distance piece is glued into the hollow spar, but so narrow is this that in several places we noticed the tacks through the rib flanges had penetrated the spar flange, missed the three-ply distance piece, and had its end projecting inside the hollow of the spar. The rear spar, which was of slightly smaller dimensions than the front spar, was different in that its upper flange had been spindled out, otherwise the two spars were similar, also in that in both the top flange was not quite so thin as the bottom flange. The spars were constructed of what appeared to be some kind of pine, possibly Dantzig.

Where the bolt, serving as an anchorage for the wire running to the top plane occurred, the spar was strengthened by a packing piece of peculiar form. This is shown in some of our sketches, which will, we hope, help to explain it. It will be seen that the saw cuts in the ends of this distance piece, leaves four tapering ends, which would have the effect of cantilever beams proportioned to carry an end load, the latter being considered as the lateral load on the spar at this point. Whether this, however, was in the designer's mind is doubtful. It is more probable that the shape of the piece is the result of an attempt at stiffening the spar for a considerable

distance on each side of the joint, without carrying too much weight. The vertical bolt, to which reference was made above, is not passed through the spar itself, but through an additional stiffening piece glued to the front face of the spar. Two horizontal bolts through the spar, securing on the rear face of the spar the compression strut for the internal wing bracing, are the only attachment, apart from the glue, of this vertical packing piece to the spar proper. It is to be imagined that a pull on the inter-plane wire must result in a tendency to twist the spar, placed, as it is, so far from the vertical neutral axis of the spar. Altogether this joint impresses one as being very poorly designed indeed, in fact, it has the appearance of not having been designed at all.

The outer inter-plane struts are stream-line steel tubes, with a diagonal tube welded to them in the manner shown in the illustrations. In addition to this diagonal tube there is a wire running diagonally in the opposite direction, probably to ensure that the welded joints of the struts shall not have to work in tension under the changes in load, caused by the travel of the centre of pressure.

The ailerons, which have their tips at a slightly smaller angle of incidence than that of the inner ends, are hinged to a false spar slightly to the rear of the rear main spar. The section of this false spar is shown in one of our sketches. The leading edge of the *aileron* is in the form of a steel tube, partly enclosing which—and at some distance from it—is a strip of three-ply wood, the object of which evidently is to provide the requisite depth of the leading edge of the *aileron* without going to the extra weight of a tube of sufficient diameter. The method of attaching the ribs to this tube is also indicated in the sketches. A short strip of steel, quite thin, is bent around the tube, its two ends projecting back, and being accommodated in a slot in the rib. This strip is then soldered—and probably pinned, although this could not be ascertained—to the tubular leading edge.

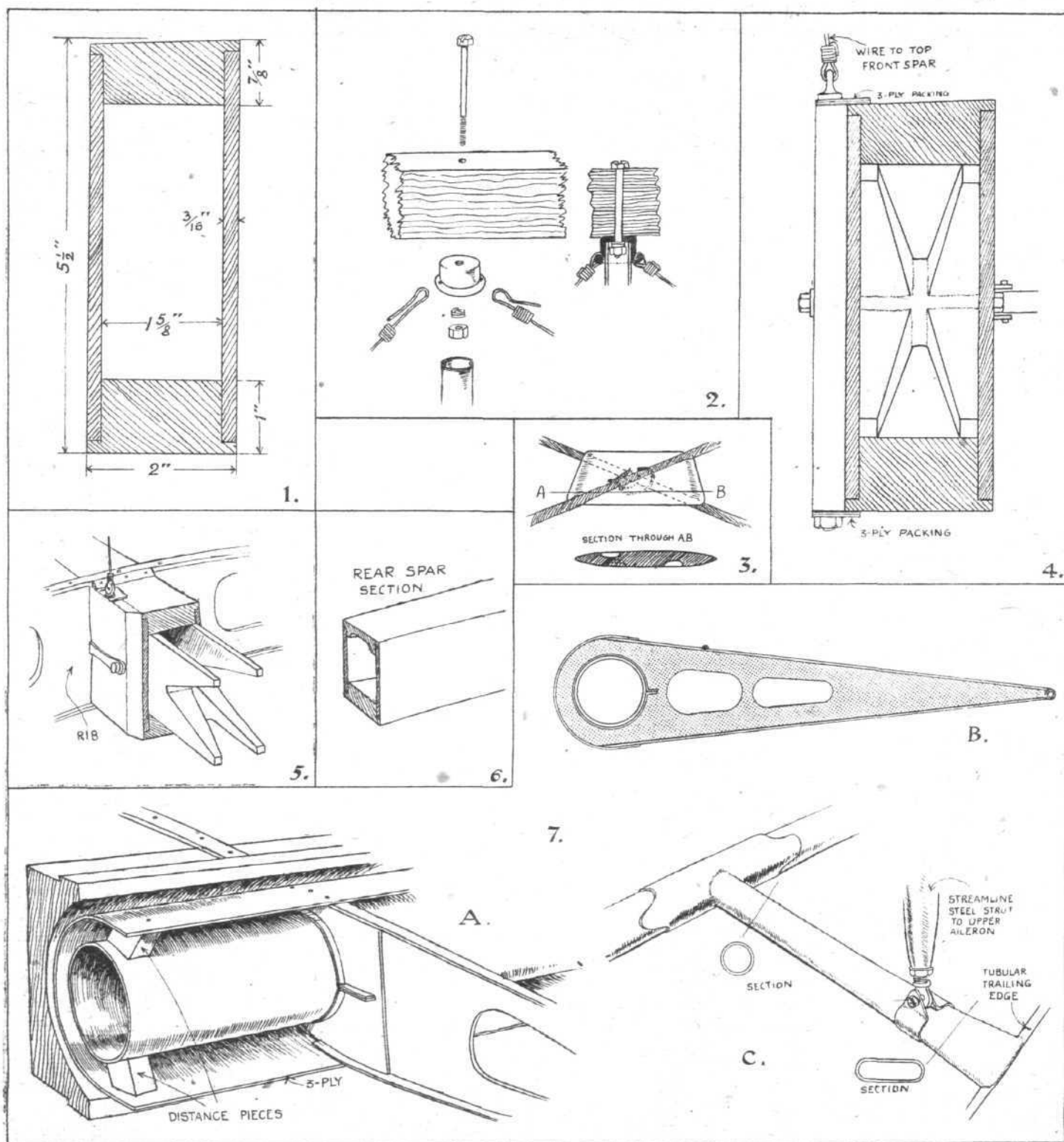
Half-way between consecutive ribs, in order to help it retain its shape, small distance pieces are tacked to the three-ply, having their free ends abutting on the surface of the tube. Another sketch shows the tube to which the inter-*aileron* strut is attached. The crank lever of the upper *aileron* is a somewhat weird and complicated affair, having a forward projection curving up over the false spar, and dipping down in an opening between two ribs. To this projection is attached one of the *aileron* control cables, which runs over a pulley in the lower spar and internally in the lower wing to the cranks on the longitudinal rocking shaft. In plan view the *aileron* crank lever is bent and runs through a rib, the clip attaching it to the inter-*aileron* strut being similar to that of the lower *aileron* shown in the sketch. From this *aileron* crank, a cable passes over another pulley in the same casing as that of the first, and hence through the lower plane to the controls. It will thus be seen that both elevating and depressing the *aileron* is a positive movement.

The tubular leading edge of the *ailerons* is supported by a small bearing at the inner end, and by two clips of steel bent over the tube and bolted to the false spar at certain intervals. Thus each *aileron* is carried in three bearings. The outer end of the leading edge of the *aileron* is free. A fact which at once impresses itself on one in looking at the lateral control of the Ago is that the point from which the

aileron is actuated is very near its inner end, leaving a very large amount of the aileron area outside, a fact which must give rise to considerable twisting stresses.

The tail planes are of similar construction as that of the main planes, the same form of box spars being

adjusting the angle of incidence of the tail. The vertical fin, which is of tubular construction, is mounted on and moves with the tail plane. No very great amount of adjustment is therefore possible, as a comparatively small movement of the rear spar of the tail plane brings the rudder against the edge of the



THE AGO BIPLANE.—More Constructional Details. 1. Dimensions of lower front spar near body. 2. Attachment of tubular struts to fuselage longerons. 3. The hardwood distance piece at the crossing of the internal wing-bracing cables. 4. Section of the lower front spar at the point of attachment of the interplane wire. 5. Perspective sketch of same joint. 6. Section of rear spar. 7. (A) construction of false spar and aileron leading edge; (B) An aileron rib (not to scale); (C) Aileron crank and attachment of inter-aileron strut.

employed. The stabilising plane is brought to the same level as the top of the fuselage, by dropping the lower longerons, somewhat after the fashion of the old Deperdussin monoplanes. A clip secures the front spar of the tail plane to the longerons, while the rear spar is attached by means of a sliding clip arrangement, which allows (not during flight) of

cut out portion of the fin. (See illustration.) The rudder, which is also built of steel tubes, has no support above the stern of the body, this being difficult to obtain in conjunction with the adjustable fin. The result is that the rudder is very much overhung and does not look any too strong for its work.

The under carriage is of the Vee type, built of



steel tubes streamlined with wooden fairings. The axle is slung, by means of rubber band, from the apex of the Vee, and is enclosed in a streamline casing of aluminium. The lower half of this casing is bolted to the transverse tube of the chassis, while the upper half is hinged along this transverse tube

and is allowed to move its trailing edge up and down according to the travel of the axle. A stout wooden tail skid sprung by means of rubber chord inside the fuselage, has, at its outer end, a metal protector in the form of a hemispherical bowl bolted to the end of the skid.

## The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

### THE FLYING SERVICES FUND, administered by THE ROYAL AERO CLUB.

The Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

Forms of application for assistance can be obtained from

the Royal Aero Club, 3, Clifford Street, New Bond Street, London, W. 1.

#### Subscriptions.

	£	s.	d.
Total subscriptions received to Dec. 5th, 1917..	12,497	13	0
Collected in the Buying Office of the Aircraft Manufacturing Co., Ltd. ..		2	0
Staff and workers of Gwynnes, Ltd. (Fifty-second contribution) ..		11	3

Total, December 11th, 1917 .. 12,510 16 6

H. E. PERRIN, Secretary.

3, Clifford Street, New Bond Street, W. 1.

## THE ROLL OF HONOUR.

### Reported by the Admiralty:—

#### Accidentally Killed.

Prob. Flight Officer E. H. Dyson, R.N.  
F. 5276 Air-Mech., 1st Grade, A. E. Scott, R.N.A.S.  
F. 4131 Ldg. Mech. E. J. Wilson, R.N.A.S.

### Previously reported Died of Wounds, now reported Accidentally Killed.

Flight Sub-Lieut. W. J. Beattie, R.N.

#### Drowned.

F. 11827 Acting Air-Mech., 1st Grade, E. Allen, R.N.A.S.

#### Missing, believed Drowned.

Flight Sub-Lieut. L. H. G. Gillespie, R.N.  
Obsr. Sub-Lieut. H. Odle, R.N.

#### Wounded.

Capt. A. C. St. Clair-Morford, M.C., R.M., attd. R.F.C.

#### Accidentally Injured.

Flight Sub-Lieut. O. P. Adam, R.N.  
Flight Sub-Lieut. F. E. Dixon, R.N.  
Prob. Flight Officer K. W. J. Hall, R.N.

### Previously Missing, now reported Prisoners.

Flight Commander A. W. Clemson, D.S.C., R.N.  
Flight Sub-Lieut. H. G. B. Linnell, R.N.  
Flight Sub-Lieut. A. Macdonald, R.N.  
Flight Lieut. L. G. Sieveking, D.S.C., R.N.  
Flight Sub-Lieut. J. S. Smith, R.N.

### Previously reported Missing, now reported Not Missing.

Obsr. Sub-Lieut. A. D. Rogers, R.N.  
Flight Sub-Lieut. R. J. Stallard, R.N.

### Reported by the War Office:—

#### Killed.

2nd Lieut. G. J. Cooke, London, attd. R.F.C.  
Lieut. C. H. Dixon, R.F.C.  
Lieut. S. M. Goodeve, Can. F.A., attd., R.F.C.  
2nd Lieut. W. H. Harston, North'n, attd. R.F.C.  
2nd Lieut. W. G. Heathcote, R.F.C.  
2nd Lieut. W. E. Jenkins, E. Surrey, attd. R.F.C.  
2nd Lieut. C. M. Pears, R.F.C.  
Lieut. C. H. M. Platt, R. War., attd. R.F.C.  
Lieut. J. A. Pullan, Dur. L.I., attd. R.F.C.  
Lieut. W. M. D. S. Strettell, High. L.I., attd. R.F.C.  
2nd Lieut. M. West-Thompson, R.F.C.  
2nd Lieut. A. L. Wylie, M.C., R.F.C.  
2nd Lieut. G. J. T. Young, R.F.C.  
51746 2nd Air-Mech. G. C. Bradbury, R.F.C.  
20834 1st Air-Mech. M. Davies, R.F.C.  
65042 1st Air-Mech. W. M. Goldsmith, R.F.C.  
3097 Pte. J. Willey, Lrs., attd. R.F.C.

### Previously reported Missing, now reported Killed.

2nd Lieut. H. E. Arnold, R.F.C.  
Lieut. J. L. Bamford, R.F.C.  
Lieut. F. B. Best, S.C., attd. R.F.C.  
2nd Lieut. J. H. Binns, R.F.C.  
Capt. W. S. Brayshay, A.S.C., attd. R.F.C.  
Capt. J. S. de L. Bush, Som. L.I., attd. R.F.C.  
2nd Lieut. W. H. Gunner, M.C., R.F.C.  
Lieut. C. H. Morris, R. Welsh F., attd. R.F.C.  
2nd Lieut. A. Ormerod, R.F.A., attd. R.F.C.  
88163 2nd Air-Mech. W. Addison, R.F.C.  
65004 Sergt. W. D. A. Backhouse, R.F.C.  
3223 1st Air-Mech. G. Stewart, R.F.C.  
61869 2nd Air-Mech. E. Wood, R.F.C.

### Previously reported Wounded, now reported Died of Wounds.

2nd Lieut. K. Le G. Mills, R.F.C.

### Previously reported Missing, now reported Died of Wounds as Prisoner in German hands.

2nd Lieut. W. H. T. Williams, R.F.C.

#### Died of Wounds.

2nd Lieut. S. R. Hanafy, R.F.C.  
Lieut. D. G. Morrison, Aus., F.C.  
2nd Lieut. A. C. Roxburgh, Yeo., attd. R.F.C.  
15998 2nd Air-Mech. W. E. Guernsey, R.F.C.

#### Died.

22353 2nd Air-Mech. P. H. T. King, R.F.C.  
49398 2nd Air-Mech. W. H. Toozee, R.F.C.

#### Wounded.

Lieut. J. A. V. Boddy, R.F.C.  
Lieut. J. I. Bundy, Can. M.G.C., attd. R.F.C.  
Lieut. R. D. Coath, Yeo., attd. R.F.C.  
Capt. E. R. Cottier, R.F.C.  
Capt. C. Courtneidge, R.F.C.  
Lieut. H. E. T. Crocker, I.A.R.O., attd. R.F.C.  
2nd Lieut. J. D. de Pencier, R.F.C.  
2nd Lieut. D. O. Duthie, R.F.C.  
2nd Lieut. C. W. Dunford, R.F.C.  
Lieut. W. W. Fielding, Yeo., attd. R.F.C.  
2nd Lieut. D. Francis, Leic., attd. R.F.C.  
2nd Lieut. H. Hammond, Dorset, attd. R.F.C.  
2nd Lieut. W. L. King, Aus. F.C.  
Capt. J. A. Mansfield Yorks, attd. R.F.C.  
Lieut. W. A. Miller, Sask., attd. R.F.C.  
Lieut. J. W. Mitchell, Yeo., attd. R.F.C.  
2nd Lieut. C. A. Mulligan, R.F.C.  
Lieut. A. C. T. Perkins, M.C., R.G.A., attd. R.F.C.  
2nd Lieut. T. F. Pilcher, R.F.C.  
2nd Lieut. C. M. Powell, R.F.C.  
2nd Lieut. D. J. Rolls, R.F.C.  
Lieut. W. H. M. Wardrope, Can. Cav., attd. R.F.C.

Unless otherwise mentioned, the following are Mechanics in the R.F.C., the figures in brackets indicating the grading:—

9975 (2nd) J. W. Beadon, 106064 (3rd) T. Cannon, 58523 (2nd) H. Cohen, 43257 (2nd) J. F. Cordings, 9142 (2nd) J. L. Cousen, 8449 (1st) B. Gibson, 44356 (2nd) H. Jordan, 57705 (3rd) H. Revell, 26899 (2nd) J. Simpson, 10303 (2nd) J. B. Bell, 25160 (2nd) D. Burn, 103627 (2nd) G. Kirton, 26692 (Flight-Sergt.) A. S. Norman, 14237 (2nd) J. McLean, 20682 (1st) W. E. Middlehurst, 52518 (2nd) S. G. Oxborough, 276 (Sergt.) Weare, 10459 (Sergt.) T. J. Whebbby, 24110 (1st) S. A. J. Wingrove, 53095 (2nd) W. J. Griffiths, 51968 (2nd) W. Morris, 4055 (Corpl.) W. F. H. Rapley.

## Missing.

2nd Lieut. E. J. Blackledge, L'pool R., attd. R.F.C.  
2nd Lieut. W. A. Booth, R.F.C.  
2nd Lieut. C. H. Brown, R.F.C.  
2nd Lieut. R. A. Forsyth, R.F.A., attd. R.F.C.  
2nd Lieut. G. J. Howells, R.F.C.  
2nd Lieut. E. R. Joicey, M.C., Lancers.  
Lieut. C. F. Keller, Lond. R., attd. R.F.C.  
2nd Lieut. J. F. MacKinnon, R.F.C.  
2nd Lieut. R. Main, R.F.C.  
2nd Lieut. W. G. Mann, R.F.C.  
2nd Lieut. L. Marshall, R.F.C.  
Lieut. J. McCash, Black Watch, attd. R.F.C.  
Lieut. J. P. McRae, Can. A.S.C., attd. R.F.C.

Lieut. T. W. Morse, Cent. Ont., attd. R.F.C.  
2nd Lieut. A. Muir, R.F.C.  
2nd Lieut. G. Noon, Sher. For., attd. R.F.C.  
2nd Lieut. E. D. Perney, R.F.C.  
2nd Lieut. A. Rosenthal, R.F.C.  
Lieut. F. H. Stephens, Cent. Ont., attd. R.F.C.  
7216 Sergt. C. J. Butler, R.F.C.  
103725 2nd Air-Mech. W. T. Long, R.F.C.  
57731 2nd Air-Mech. T. C. Robertson, R.F.C.

## Previously reported Missing, now reported Prisoners in German hands.

2nd Lieut. I. C. F. Agnew, Aus. F.C.  
2nd Lieut. L. M. Archibald, R.F.C.  
Lieut. J. M. Atkinson, A.S.C., attd. R.F.C.  
2nd Lieut. C. H. Bartlett, R.F.C.  
2nd Lieut. R. A. Cartledge, R.F.C.  
2nd Lieut. F. S. Clark, R.F.C.  
2nd Lieut. F. B. Farquharson, R.F.C.  
2nd Lieut. K. L. Golding, R.F.C.  
Lieut. R. S. Greenslade, R.F.C.  
2nd Lieut. A. E. Hempel, R.F.C.  
Capt. D. Owen, Can. Gen. List, attd. R.F.C.  
2nd Lieut. B. B. Perry, R.F.C.  
2nd Lieut. S. L. Whitehouse, R.F.C.  
7124 Sergt. H. L. Clear, R.F.C.  
25233 Sergt. F. Legge, R.F.C.

## "X" AIRCRAFT RAIDS.

IN view of the decision of the Government not to allow details of places visited by enemy aircraft to be published, we are, as before, giving to each one an index number. Eventually, when details are available, we shall give the respective information under these index numbers, which will facilitate easy reference to each particular raid.

### "X 84" Raid (December 6th).

The following *communiqués* were issued by the Field-Marshal Commanding-in-Chief, Home Forces, on December 6th:—

" 1.45 p.m.

" A raid by about 25 enemy aeroplanes took place early this morning. The first group of raiders came in over Kent at 1.30 a.m., and dropped bombs at various places on and near the coast. A second group made the land shortly after 3 a.m., the various machines proceeding up the Thames and some distance into Kent. Both the above groups appeared to have carried out preliminary attacks with the object of drawing gunfire and exhausting the defences, for it was not until an hour later that the most serious attack developed.

" Between 4 and 4.30 a.m. two groups of enemy machines crossed the Essex Coast and three groups the Kent coast, proceeding towards London on converging courses. Their tactical plan seems to have been to deliver five simultaneous

attacks on the capital from the north-east, east, and south-west. The whole of one group, however, was turned back by gunfire, and of the others not more than five or six machines penetrated into London. One or two explosive, and a large number of incendiary, bombs were dropped in various districts at about 5 a.m.

" Two of the raiders fell victims to our defences, in each case the entire crew of three men being captured alive. A number of fires occurred in London, but all were speedily got under control by the Metropolitan Fire Brigade. Casualties are believed to be light, but full police reports have not yet been received. A number of our own aeroplanes went up, and all landed safely."

" 4.45 p.m.

" Latest police reports state that—

" In the Metropolitan area three persons were killed and 11 injured in this morning's air raid. Outside London four persons were killed and 11 injured. Material damage is slight."

### German Version.

" Berlin, December 6th.

" Our aviators bombed the harbour establishments of Calais, as well as London, Sheerness, Gravesend, Chatham, Dover, and Margate. Large and numerous fires showed the effectiveness of these attacks."

### The King and Queen at Hendon.

THE King and Queen attended by the Countess Fortescue, Major Reginald Seymour and the Earl of Cromer, visited the Integral Propeller Company at Hendon on December 4th, and were received by Mr. H. E. Latimer-Voight (Managing Director), Mrs. Latimer-Voight (Director and Secretary) and Mr. L. Saunders (Works Manager). An extensive tour of the works was made, their Majesties taking great interest in the various processes of manufacture, Mr. and Mrs. Latimer-Voight having to explain the methods. The foremen and charge hands were all introduced to their Majesties, who expressed great appreciation of the excellent work done.

At the end of the inspection, their Majesties and suite took coffee in Mr. and Mrs. Latimer-Voight's private office, and the Queen graciously accepted a model propeller made to scale as well as a propeller brooch made out of a fragment of Zeppelin. As their Majesties departed, the employees gave their Majesties a hearty cheer.

Their Majesties then visited the works of the Grahame-White Aviation Co., Ltd., and were received by Mr. Claude Grahame-White (Chairman and Managing Director). A tour was made of the various shops, including the erecting shop, the machine department, the fitting rooms, the wing-making department, the wood-working factory, and the doping rooms. The King climbed into the seat of a completed machine and Mr. Grahame-White explained the various instruments and fittings.

Before leaving the works, the King laid the foundation-

stone of a new permanent canteen which it is proposed shall take the place of the temporary structure which is now in use. It had been intended that their Majesties should witness a display of flying, but owing to the foggy weather that part of the programme had to be abandoned.

### The British Rigid Over London.

AT last the Metropolis has had a sight of a British rigid airship—or British Zeppelin as it has been popularly named. Heralded by the noise of engines and propellers it dramatically appeared out of the mist on December 6th, and after circling for some time over the city disappeared again into the grey mist. Except for the British "target" and the tri-colour on the four-bladed tail the airship was very similar in appearance to the German Zeppelin; as it cruised over London at a low altitude, thousands had a good view of the general arrangement of the cars, etc.

### Gift from Malaya to Australia.

MR. HOPE, a solicitor of Ipoh (Malay Peninsula), has presented his second Malayan battleplane to Australia.

### To Readers—One and All.

THE Editor of "FLIGHT" will at all times be pleased to consider original articles (illustrated or otherwise) on subjects directly or indirectly allied with aviation. All articles accepted will be paid for; a high literary standard of writing is not essential; it is the facts which matter. Practical explanatory articles are most acceptable. Diagrams and similar illustrations need only be rough sketches if necessary.



# THE 230 H.P. BENZ AERO ENGINE.

(Continued from page 1278.)

**Crankcase.**—The details of the crankcase are clearly shown in the photographic views of the top and bottom halves (Figs. 13 and 14).

The method of cooling the interior of the crank chamber and sump indicates the fact that this matter has received most careful consideration in design. In the top half of the crankcase six of the seven main

side of the engine. A corresponding but reversed cowl is fitted on the exhaust side.

Breathers are also fitted into the top half of the crank chamber. The simple type of wire spring clip fitted to the breathers should be noted.

**Carburation system.**—Two separate carburettors are fitted, each feeding three cylinders. These are

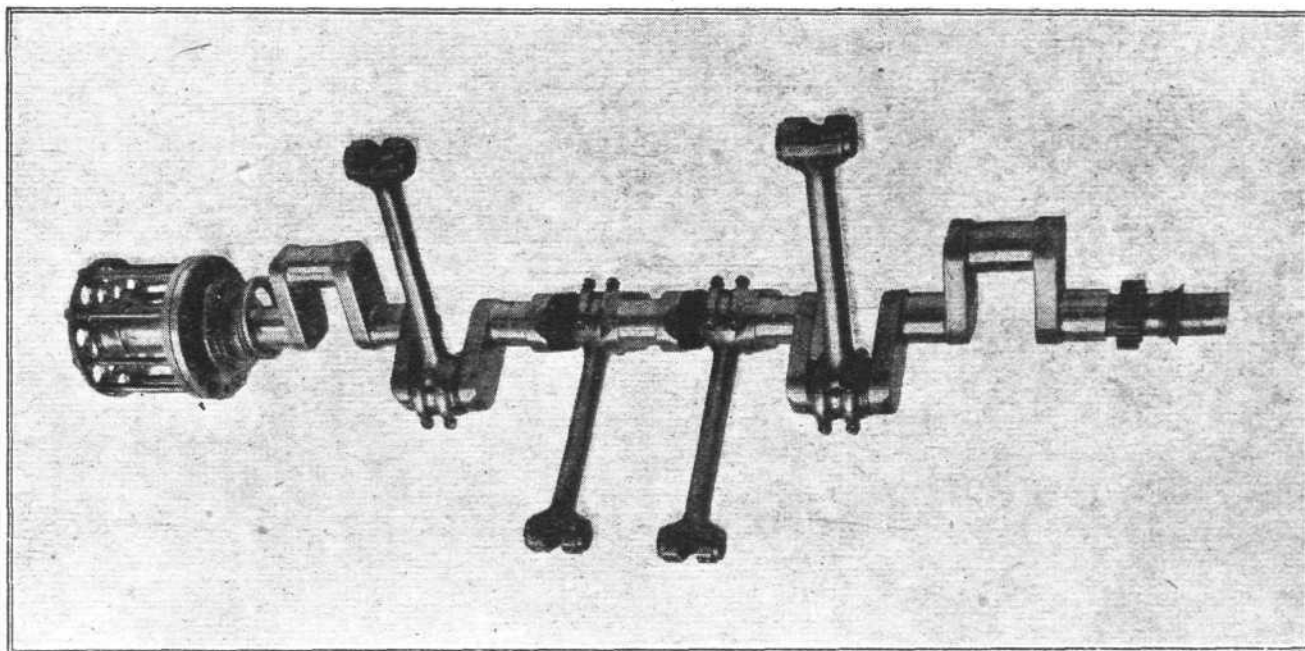


Fig. 12.—The crankshaft and propeller boss.

bearing housings are cast so that the webs form air passages transversely across the engine. Two of these passages form the air intake passages for the two carburettors—similarly to those of the 160 h.p. Benz engines—as already stated. A section through one of these passages is shown in Fig. 16.

The bottom half of the crank chamber is extended to form an oil sump and is of unusual design. The lower portion is cooled by 18 30-mm. aluminium tubes fixed transversely across the base chamber, the air being scooped into the cooling tubes by a large sheet aluminium louvred cowl on the induction

attached by flanges to the side of the top half of the crank chamber.

Referring to the sectional drawing of the carburettor (Fig. 16), it will be seen that the pilot jet is formed by an extension of the brass tube into which the main jet is screwed.

This combined jet is screwed obliquely into the bottom of the float chamber casting and not into the body of the carburettor. The float chamber is attached to the body of the carburettor by two bolts, and the throttle is of the horizontal barrel type.

As already mentioned, the main air intake passages are cast in the crank chamber between the webs of the main bearings, air entering each carburettor through two ports cut in the end of the throttle, and also through the air passage at the base of the carburettor below the jets.

At full throttle most of the air is taken through the

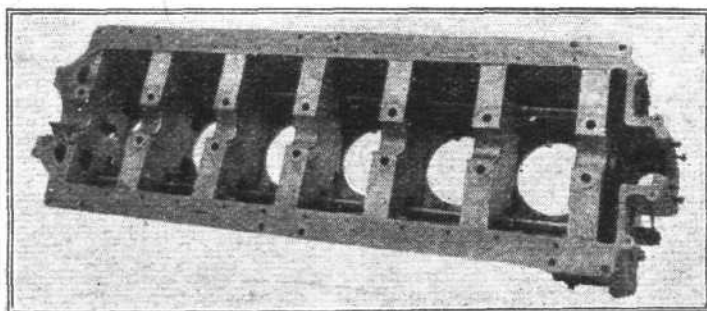


Fig. 13.—View of top half of crank case.

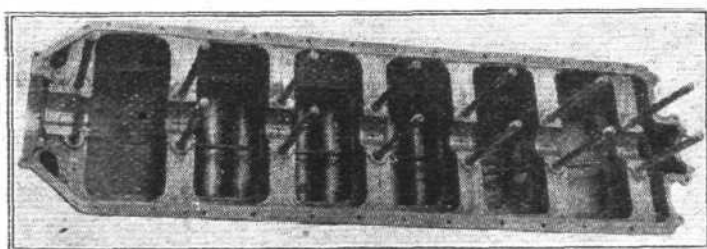


Fig. 14.—Bottom half of crank case.

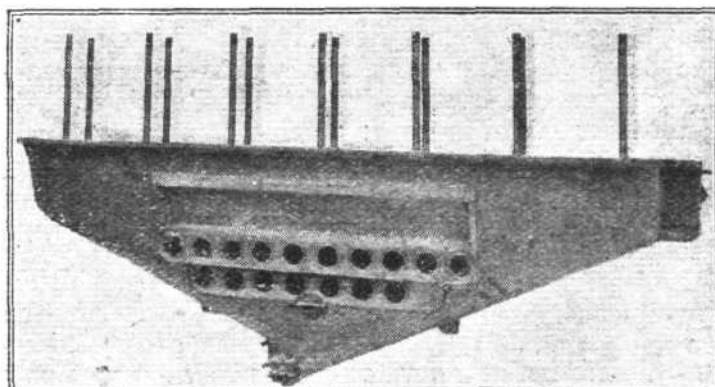


Fig. 15.—Side view of bottom half of crank case, showing air-cooling tubes.

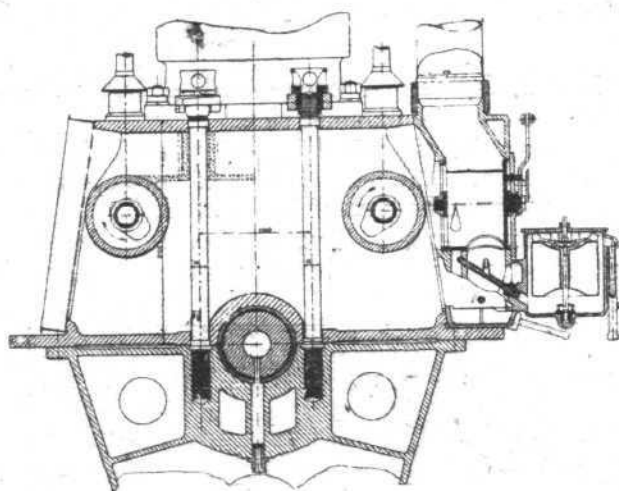


Fig. 16.—Arrangement of carburettor and section through air-intake passage in top half of crank chamber.

air ports in the throttle above the jets. When the throttle is closed for slow running the main jet is completely cut off, and all the air is taken through the passage containing the pilot jet. The slow running of the engine is very good.

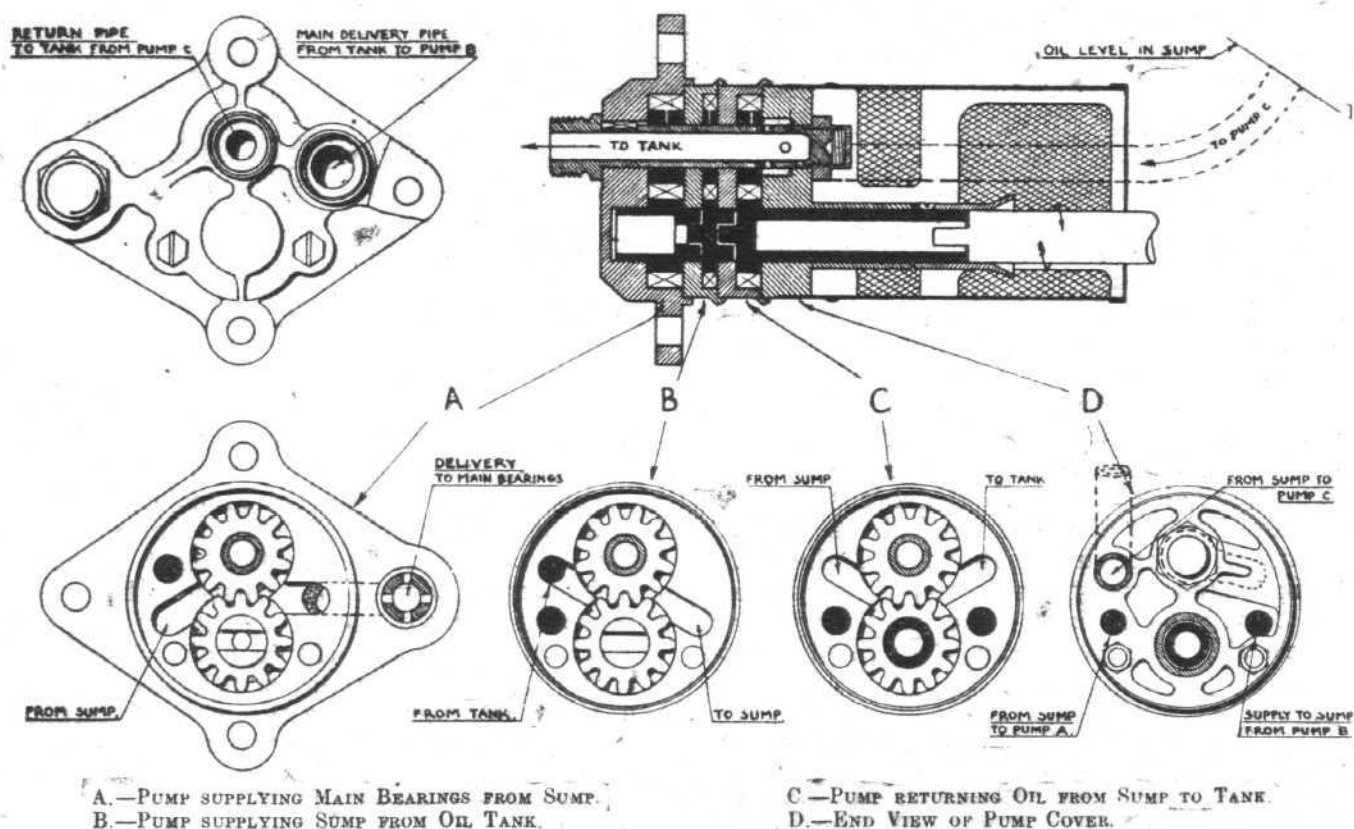
interesting. These are built up of aluminium tubes with cast aluminium flanged bends, and weigh only 2.625 lbs. each complete with connections. The internal diameter of the induction pipe equals 58 mm.

The attached R.A.F. test report computes the petrol consumption at 150 pints per hour, equalling 0.65 pint per brake horse-power hour.

The connections between the flanged bends of the induction pipes and the cylinders, and also between the bottom ends of the induction pipes and the carburettors are made with rubber ring joints secured by wide band clips as shown in Fig. 1.

These joints, when loosened, being more or less flexible, allow any one of cylinders to be removed without disturbing the other joints of the induction branched pipes.

**Lubrication.**—Pressure feed lubrication to the crankshaft and connecting-rod bearings is efficiently carried out by an exceptionally small high-speed gear pump working submerged in the reservoir formed in the bottom of the sump. The oil pump is virtually a triple gear pump with three functions. Details of this oil pump are shown in the sectional drawings



A.—PUMP SUPPLYING MAIN BEARINGS FROM SUMP.  
B.—PUMP SUPPLYING SUMP FROM OIL TANK.

C.—PUMP RETURNING OIL FROM SUMP TO TANK.  
D.—END VIEW OF PUMP COVER.

Fig. 17.—Details of oil pump.

The air intake ports in the end of the throttle are so designed that the petrol air ratio remains practically constant over a wide range of throttle opening up to nearly half throttle; the last movement of the throttle, however, causes no increase in petrol flow, but on the contrary a slight decrease. No compensating arrangement is fitted for high altitude control. The body of the carburettor around the throttle is water-jacketed, and is connected by an arrangement of steel piping to the delivery of the water pump, and also to the lower water connections at the bottom of the water jackets between each pair of cylinders. The arrangement is clearly shown in the side view of the engine (Fig. 1).

The design of the branched induction pipes is

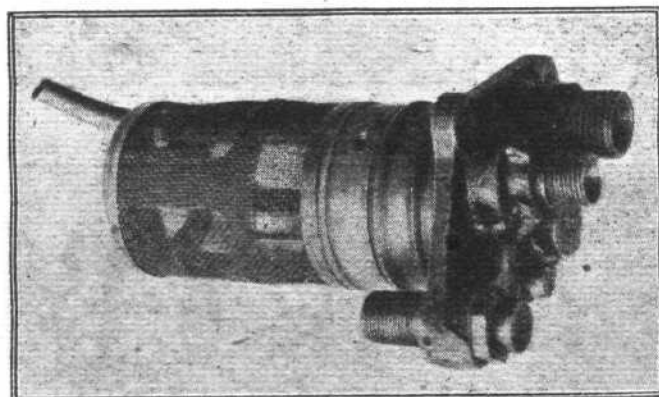


Fig. 18.—The oil pump complete.



(Fig. 17), and in the photograph of the parts (Figs. 18 and 19).

The oil pump works diagonally in the sump, and is driven by a long shaft and gear wheel which meshes obliquely with the distribution pinion on the rear end of the crankshaft.

The functions of the triple oil pumps are as follows:—

Oil is drawn by the main pressure pump A (Fig. 17) from the reservoir in the sump through the holes in the end cover of the pump, lubricating the main bearings through the main oil pipe and the small branch pipes and hollow crankshaft, thence to the gudgeon pin bearings through the small pipes inside the tubular connecting-rods. The surplus oil is thrown out from the hollow cranks on to the camshafts, &c., and returns by gravity to the sump, flowing over the air-cooling pipes in the base. The fresh oil is fed into the sump reservoir by the small suction pump B from the oil tank, whilst the correct working oil level is maintained in the reservoir by the gear pump C, the oil being drawn off through the bent pipe E, and returned to the oil tank. The fresh oil from the oil tank passes through a cylindrical gauze filter, which is attached to the under side of the crank chamber.

The complete oil pump with its filter is easily detachable from the sump by the studs through the flange. A small spring loaded ball is used as an oil pressure release valve in the main oil supply pipe.

The gears of the oil pump and also the pump body are of cast iron, and the weight of the complete pump equals 2.89 lbs.

Oil consumption during R.A.F. test is stated to be 4.5 pints per hour, equalling 0.02 pint per b.h.p. hour.

Oil pressure equals 50 lbs. maximum, 28 lbs. normal.

**Ignition.**—Two Z.H.6 magnetos are mounted on brackets at the rear end of the crank case, and are driven directly off the camshaft gear wheels. The design of this magneto drive is very neatly carried out and is clearly shown in the rear end view of the engine (Fig. 3). The contact breakers of the magnetos are advanced or retarded by small toothed quadrants which mesh with teeth cut in the underside of the cam box, and the interconnected levers of the timing advance quadrants are coupled by a rod which passes through the end of the crank case casting.

Two sparking plugs are fitted to each cylinder, one on each side, and the H.T. wires are carried in a sheet aluminium casing attached to the cylinders.

The ignition is timed as 30° E fully advanced, equalling 18 mm. on stroke.

Power throttle and consumption curves are shown in Fig. 28. The engine was run up to 1,700 r.p.m., the peak of the power curve occurring at 1,650 r.p.m., at which 250 h.p. was developed. The maximum brake m.e.p. reached 119 lbs. per square inch at 1,100 r.p.m. The results of a one-hour test run were as follows:—R.P.M., 1,400; B.H.P., 229; petrol consumption, 150 pints; oil consumption, 4.5 pints; water inlet temperature (average), 62° C.; water outlet temperature (average), 71° C.; oil temperature (max.), 50° C. steady; oil pressure (min.), 28 lbs. sq. in. steady.

The curve (Fig. 29) shows inlet and exhaust valve

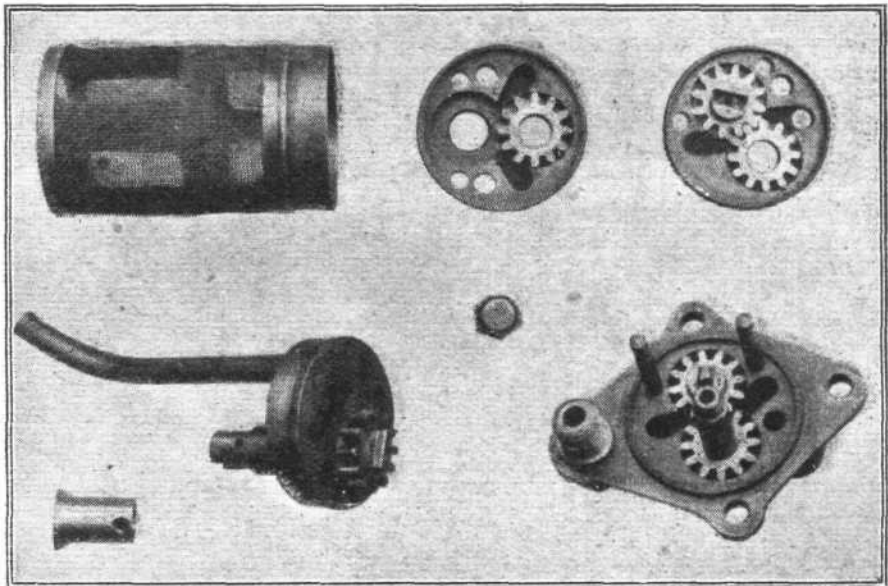


Fig. 19.—Parts of oil pump.

lifts at various angles of rotation. The engine was erected on a test bed and coupled to a Heenan and Froude water dynamometer. After preliminary running, during which the exhaust manifold broke and was replaced by one from a similar engine, the attached power, throttle, and consumption curves were obtained.

#### 230 H.P. BENZ.

List of comparative weights of parts and their Percentage of total weight of engine.

Description of Part.	Lbs.	Per cent. Total Weight.
Cylinders, complete, including supports for rocker levers (six at 44.25 lbs. each) .. .. .	265.5	30.753
Pistons, complete, with rings and gudgeon pins (six at 7.62 lbs. each)	45.72	5.296
Connecting rods, complete (six at 7.13 lbs. each) .. .. .	42.78	4.955
Valves and springs complete (twenty-four at 1.14 lbs. each) .. .. .	27.36	3.169
Tappets, push rods and rocker levers (twelve sets at 3.2 lbs. each) ..	38.4	4.447
Induction pipes, complete (two at 2.625 lbs. each) .. .. .	5.25	0.608
Carburettors, complete (two at 6.54 lbs. each) .. .. .	13.08	1.515
Crank chamber, top half .. .. .	103.25	11.959
Crank chamber, bottom half (including cylinder studs and oil pump shaft) ..	110.25	12.77
Crankshaft, complete .. .. .	109.25	12.66
Propeller boss, complete .. .. .	19.32	2.236
Cam-shafts, complete, with bearings less gear-wheels (two at 8.25 lbs. each) .. .. .	16.5	1.912
Magnetos, complete (two at 10.75 lbs. each) .. .. .	21.5	2.490
Ignition wiring, complete (two at 2.12 lbs. each) .. .. .	4.24	0.491
Water pump, complete .. .. .	8.75	1.013
Oil pump, complete .. .. .	2.89	0.335
Petrol pump, complete .. .. .	6.75	0.782
Exhaust manifold .. .. .	15	1.737
Miscellaneous parts .. .. .	7.53	0.872
<b>Total weight of complete engine</b>	<b>863.32</b>	<b>100</b>

#### 230 h.p. Benz Engine Data.

Number and arrangement of cylinders, 6 vertical; bore, 145 mm. (5.71 ins.); stroke, 190 mm. (7.48 ins.); stroke/bore ratio, 1.31-1.

Stroke volume of one cylinder, 3,137.476 cu. cms. (191.386 cu. ins.); total stroke volume of engine, 18,824.856 cu. cms. (1,148.316 cu. ins.)

Area of one piston, 165.13 sq. cms. (25.59 sq. ins.); total piston area of engine, 990.78 sq. cm. (153.57 sq. ins.)

Clearance volume of one cylinder, 796 cu. cms. (48.66 cu. ins.); compression ratio, 4.91-1.

Normal b.h.p. and speed, 230 b.h.p. at 1,400 r.p.m.; piston speed, 1,744 ft. per min.; brake mean effective pressure, 113 lbs. per sq. inch at 1,400 r.p.m.; 119 lbs. per sq. inch at 1,100 r.p.m.; cu. ins. of stroke volume per b.h.p., 4.99; sq. ins. of piston area per b.h.p., .667; h.p. per cu. ft. of stroke volume, 346.3 h.p.; h.p. per sq. ft. of piston area, 215.9 h.p.

Direction of rotation of crank, r.h.t.; direction of rotation of propeller, r.h.t.; normal speed of propeller, engine speed.

Lubrication system, forced to main bearings from reservoir in sump; brand of oil, 50 per cent. vacuum heavy and 50 per cent. sternal; oil pressure, 28 lbs. normal, 50 lbs. max.; temperature, 50° C., max.; consumption per hour, 4.5 pints; consumption per b.h.p. hour, .02 pints; specific gravity of oil, .9.

Carburettor type, 2 Benz, each feeding 3 cylinders (2 jet); mixture control, automatic; fuel consumption per hour, 150 pints; fuel consumption per b.h.p. hour, .65 pint; specific gravity of fuel, .720.

Magneto type, 2 Bosch Z.h. 6; firing sequence of engine, prop: 1-5-3-6-2-4; numbering of cylinders, prop: 1-2-3-4-5-6; speed of magneto, two-thirds engine speed; direction of rotation of magneto, facing driving end of armature, anti-clockwise; magneto timing, 30° E. 18 mm. on stroke.

Inlet valve opens, deg. on crank, 10° E.; inlet valve closes, deg. on crank, 55° L.; maximum lift of inlet valve

= h, 11.8 mm. (.465 in.); diameter of inlet valve = (smallest dia.), two of 52 mm.; area of inlet valve ports =  $\pi \times d \times h$ , 19.27 sq. cm. each; mean gas velocity through inlet valve, 124 ft. per sec.; clearance of inlet tappet, .009 in.

Exhaust valve opens, deg. on crank, 60° E.; exhaust valve closes, deg. on crank, 20° L.; maximum lift of exhaust valve = h, 11.25 mm. (.443 in.); diameter of exhaust valve ports = d (smallest diam.), two of 52 mm. dia.; area of exhaust valve ports =  $\pi \times d \times h$ , 18.37 sq. cms. (each) = 2.84 sq. ins.; clearance of exhaust tappet, .015 in.; direction of rotation of revolution counter drive, facing driving shaft on engine, anti-clockwise; speed of revolution counter drive,  $\frac{1}{2}$  E.S.

Weight engine complete with propeller hub, less water, fuel and oil and exhaust manifold, 848.32 lbs.; weight per b.h.p. ditto, 3.68 lbs.; weight of exhaust manifold, 15 lbs.; weight of oil carried in engine, 18 lbs.; jacket capacity of one cylinder, 1,873 c.c.; weight of water carried in engine, 30.9 lbs.; weight of radiators, less water, 136 lbs.; weight of fuel per hour, 135 lbs.; weight of oil per hour, 5.06 lbs.; total weight of fuel and oil per hour, 140.06 lbs.

Gross weight of engine in running order, less fuel and oil, cooling system at .65 lb. per b.h.p., 996 lbs.; weight per b.h.p., ditto, 4.33 lbs.

Gross weight of engine in running order with fuel and oil for six hours (tankage reckoned at 10 per cent. weight of fuel and oil), 1,920.89 lbs.; weight per b.h.p. with fuel and oil for six hours, 8.35 lbs.

(To be concluded.)



#### British Honour for Sig. d'Annunzio.

THE award of the British Military Cross to Signor d'Annunzio, who is now a prisoner, appears to have greatly pleased the Italians. The King of Montenegro has also awarded the poet-aviator the silver medal for bravery.

#### Ash Trees for Aeroplanes.

THE appeal of the Aerial League of the British Empire to landowners to offer their ash trees for aeronautical purposes, has resulted in between three and four thousand trees being offered within the last few weeks. The Government requirements in the next twelve months are expected to exceed 200,000 trees.

#### Dealings in Tungsten and Pig-Iron.

AN Order has been issued by the Ministry of Munitions applying Regulation 30A to tungsten ores, molybdenite and metal, and products therefrom, and requires returns from those using these ores or metals. From the date of the Order (November 30th) it is an offence under the Defence of the Realm Regulations for any person, except as authorised by a

permit, to buy or sell, or enter into negotiations for the sale or purchase of any of the war material to which the Order relates. Permits under the above Order will be issued on conditions which will from time to time be stated by the Controller of Non-Ferrous Materials Supply, and which will be endorsed on the permit. The prescribed forms for returns may be obtained on application to the Controller. All ore to which the Order applies imported into the United Kingdom will be taken possession of by the Minister of Munitions and at a price which will be notified from time to time by the Minister of Munitions.

With reference to the Order made by the Minister of Munitions on July 7th, 1916, applying Regulation 30A of the Defence of the Realm Regulations to war material consisting of certain classes and descriptions of metallurgical coke, pig-iron, and steel, and to the general permit for dealing in such war material issued by the Minister of Munitions on November 1st, 1916, the Minister of Munitions announces certain modifications of the general permit as regards dealings in pig-iron.



Courtesy "L'Aérophile."

An Italian single-seater tractor biplane, constructed by the Società Gio Ansaldo. It will be noticed that the Warren system of interplane strut bracing, which was dealt with by "Marco Polo" in our issue of October 11th, has been adopted.



# AIRSIPS

## FROM THE FOUR WINDS

"We must raise the strength of our Army to its highest point, and we must have clouds of aeroplanes." Mr. Winston Churchill on British War Aims at Bedford on Monday.

COVENTRY and other excess-war-wage earner-strikers should note.

"WHEN I reached London (after a visit to the war zone in France) and heard that 50,000 munition workers were on strike in Coventry, I could not help exclaiming, 'Good God, is there not common sense enough in Coventry to avoid a strike which adds to the dangers and miseries of the men I saw tramping into the darkness, already enduring so much?'" Mr. W. A. Appleton, Secretary of the General Federation of Trade Unions, in the *Federationist*.

COMMENT is superfluous beyond suggesting that Coventry and other excess-war-wage earner-strikers should note.

DURING Saturday last, to encourage subscribers to further Tank War Loan efforts, a squadron of seven British aeroplanes and a British Naval airship appeared over Trafalgar Square, and dropped pasteboard discs bearing the following message:—

"From the British Aeroplanes to the Citizens of London: 'Help us to defend London and attack the Huns by providing us with more aeroplanes. You can do this to-day by buying National War Bonds at the Tank in Trafalgar Square. The more you buy the better chance you give those who are fighting for you.'"

THE same squadron might well give Coventry a shower upon similar lines.

*Apropos* this leaflet distribution and the dastardly Coventry down-tools episode, Major H. K. Newton, the member for the Harwich Division of Essex, was quick to take advantage of a chance to bring home to the Coventry big wage-earning "patriots" the enormity of their crime.

Seeing in the *Times* of November 30th the powerful article by Mr. Boyd Cable describing the actual results to the fighting men, and to the nation generally, of a stoppage of work in the output of aeroplanes, Major Newton had 125,000 copies printed in leaflet form. One hundred thousand of these he got the local War Committee to distribute throughout Coventry and district, whilst the remaining 25,000 copies were scattered, at his instigation, through the streets of the town by a fleet of Coventry-built aeroplanes, which let them loose at a low altitude.

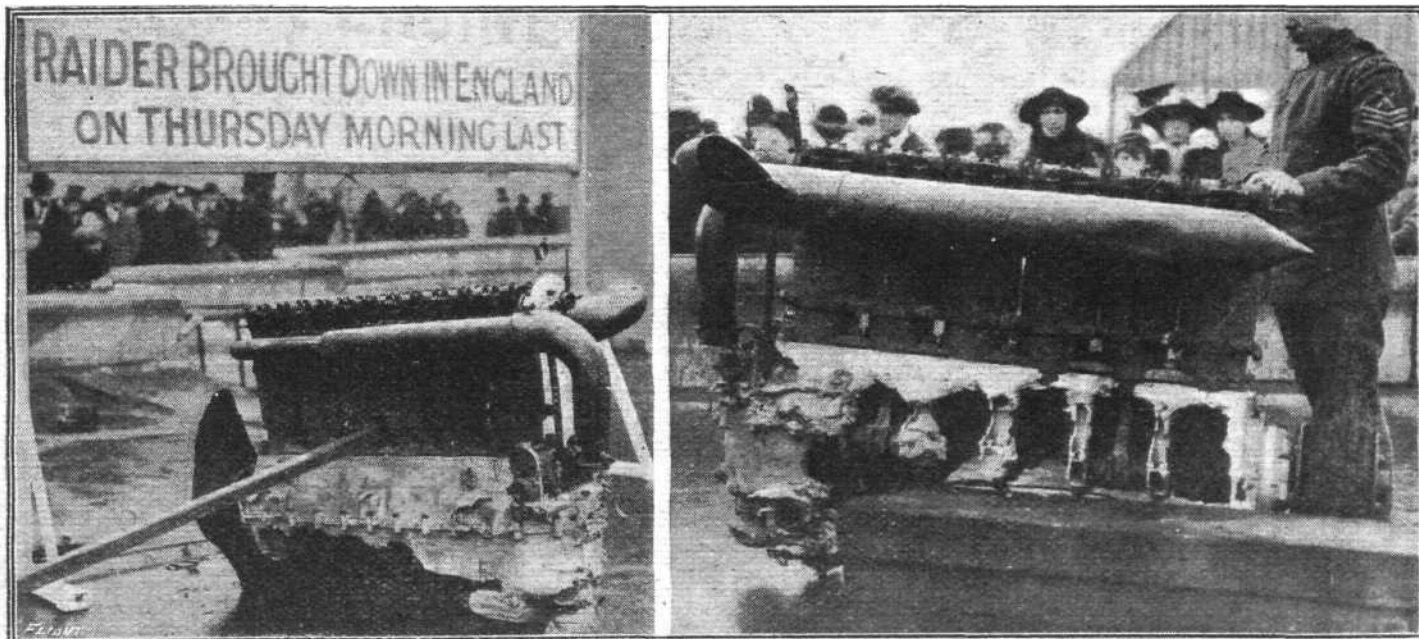
THIS is the right sort of patriotism, and a practical way of rubbing it in, and on a par in another direction, with the work

of a big London house with which Mr. Newton's father, Sir Alfred Newton, is so intimately connected, to wit, Harrods, who originated that very attractive prize stunt for winning many thousands towards the War Loan. Both good examples to emulate.

It would appear as if the personal safety of Hull's Chief Constable were estimated by the City Council as greater than the safety of the town and inhabitants' general safety. Such is the only conclusion to be arrived at in the Watch Council's refusal to permit this official to participate in observations from an airship in conjunction with a military officer, as suggested by Lord French in response to complaints as to the lights on the Hull railways. What made this decision all the more remarkable was the fact that the Watch Committee coupled with it their reason for tabooing the proposed aerial "joy-ride" to the effect that they declined to take responsibility for the Chief Constable's pension of £600 or £700 a year, if he met with an accident. Second thoughts, however, seem to have brought the local Council back to sanity, as permission has since been accorded. It is only fair to say that the Chief Constable was on the side for his very doubtful "joy-ride" and was anything but sympathetic to the suggestion of one member that the Committee should wrap him (the C.C.) in cotton wool and place him in the Guildhall.

THERE is a good story going from mouth to mouth about the gas-driven cars which make London streets look very ugly just now. A young man home from the front said to his mother, "It makes me ill to see the blue funk London people get into about air raids. Fancy having mattresses on top of their motor-cars!"—*Daily Chronicle* "Office Window."

IN the destruction of the stupendous German chemical factory and munition works of Griesheim-Elektron, near Frankfort, there is indeed a moral to be gleaned. It gives just a faint idea of the power behind the Prussian military power with which the subjection to the Hun of the entire civilised world was contemplated as a certainty. In this way. In spite of the slaughter of the Germans which has so persistently held good for more than three years, and all the other inconveniences which have been doled out by the Allies to the Central Empires, this barbarous race is still able to bring forward, at the beck of its tyrants, tens of thousands to fill gaps and accept death as their lot, for the gratification of His Satanic Majesty's rival and his satellites. Even now is this going on, if anything, in more pronounced form than ever. Yet the wiping out of this Griesheim factory, which is probably one of the greatest single disasters so far experienced by the Germans in carrying on their war operations, would appear to make but little difference to the supply of war material and beastliness at the respective fighting fronts.



A 260 h.p. Mercedes engine on view at Trafalgar Square. On the left is shown the induction side of the engine, and on the right the exhaust side. The screw, it will be seen, has been rather badly strafed.

ONE way and another the ceasing of the output from this one factory, it would have been thought, would speedily reflect upon the activities in the trenches. But no, Germany can still go on hammering at the various fronts, which suggests that the Allies are hardly likely to be helped towards freeing the civilised world of this octopus of iniquity by "a la Coventry" Bolo methods. Incidentally, war in the air may be considerably influenced by the destroying of this Hun factory, as it supplied practically all the electrolytic hydrogen for the inflation of Zeppelins and their "cousins," and for this purpose had in reserve three gasometers with a total capacity running into hundreds of thousands cubic feet. So important was it in this respect, that a Zeppelin shed, usually containing two or three airships, was erected in close proximity to the works. For the kite balloons at the front the gas was supplied in steel tubes in the liquefied state. Moreover, the extensive electrolytic plant was further utilised to produce asphyxiating gas, and lachrymatory and poisonous shells. Indeed, it was the greatest centre of this manufacture in Germany, and in 1916 the output of poison gases reached the colossal figure of nearly 600,000 cubic feet a day.

A LONDON clergyman, the Rev. J. Pughe Jones, curate of St. Anne, Brookfield, Highgate Road, who has already served as an Army Chaplain in the war, has joined the R.F.C. to train as a pilot. The Rev. Mr. Jones is probably the only London clergyman who has entered the Air Service as a "pilot," instead of as a "sky-pilot."

REFERRING to the Christmas tree air-raid warning lights of different localities, Sir George Cave, the Home Secretary, states that he is aware that several borough councils have adopted the device of exhibiting coloured lights in their districts on air-raid nights. He adds that the Commissioner of Police has arranged that any local authority may supplement the police warning to "Take cover" by exhibiting a suitable red light, and the "All clear" by a green or white light.

PRIVATE letters are always touchy things to handle with discretion. A fortnight ago we reproduced a short quotation from "The Londoner's Diary," which has for some time been a feature in our contemporary the *Evening Standard*, and we refer to it again, as it points the moral as to the sacredness of private communications. The reference was to what it feels like to be in a barrage, and we now hear from Flight-Lieut. Rosevear, whose name was coupled with the extract, that he not only did not authorise its publication, but that he strongly objects to the statement therein set forth as being a highly coloured account of a private communication, and savours, moreover, of "cheap advertisement," which Lieutenant Rosevear neither likes nor seeks. So it would appear to be up to "The Londoner" to justify the rape of this extract from a private letter.

BROUGHT down Thursday morning and on exhibition at Trafalgar Square Saturday morning! Surely that is something by way of being a record. When the German Command sent their night hawks across on the night of Thursday of last week they scarcely anticipated that one of them was to be the means, indirectly, of bucking up our War Loan Campaign. Yet there can be little doubt that the 260-h.p. Mercedes engine shown near the Tank on Saturday last helped very materially to arouse the enthusiasm of potential investors. The legend above the captured engine attracted enormous attention, especially in view of the fact that the engine was, figuratively speaking of course, hardly cold yet after its rescue from the burning wreck of the Gotha.

HERE is an extract from the first chapter of "Lorna Doone" which has caught the eye of one of our readers:—"... it is in the licence of any boy, however small and undisciplined, to rush into the great school-rooms, where a score of masters sit heavily, and scream at the top of his voice, 'P.B.' " One would almost think this was not from a romance of Dartmoor, but a story of Hertford!

A QUIANT story is going round aviation circles of the representative of a well-known firm in the aircraft industry who celebrated in very convivial fashion a satisfactory piece of business—and was awakened next morning by the voice of a hotel chambermaid at his door inquiring whether he had been sleeping in his boots as his socks had been found outside!

WHILE an *airship* was sailing gracefully over Trafalgar Square on Saturday, the crowd made a big scramble for cards which were being dropped from it to assist the appeal for more money for War Bonds. Alas for the aeronautical instruction

of the multitude—every card was headed:—"From a British *aeroplane*!" The italics are ours.

## RAID-IOGRAPHS.

A CORRESPONDENT tells us that one of his neighbours, on hearing air-raid warnings, immediately commences to play hymns on a piano—not Hymns of Hate, but something more of a Moody and Sankey vintage. He asks whether we think this is done with the idea of drowning the noise of a very healthy anti-aircraft gun in that particular part of the West End, or whether it is done by way of amusing or confusing the raiders. We give it up.

THE same correspondent says that on the occasion of the recent early morning raid what tickled him most was, after the din of the barrage had died away and everyone in the district was thoroughly wide awake, to hear a conscientious alarm clock trying to convey the glad tidings that it was 7 a.m. and time to get up.

## TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT's" precursor and sister Journal) of December, 1907. "FLIGHT" was founded in 1908.

### THE LOSS OF THE "PATRIE."

Only last week we announced that the famous French military airship the "Patrie" had taken up its permanent quarters at Verdun, one of the principal stations on the Franco-German frontier, and now, by a most extraordinary piece of ill-luck the French have lost their idol. To actually lose such an enormous machine as an airship would almost seem impossible, but the fact remains that it was literally blown away in a gale, which carried it across France, England and Ireland. It was on Saturday evening that the occurrence took place, a temporary descent having been made at Souhesmes on the day before, owing to a breakdown in the engine, brought about by the mechanic's clothing getting entangled in the gearing. During the Saturday evening the wind increased in force, and about 8 o'clock assumed the proportions of a gale. No fewer than 180 men were holding the airship down, but as those who have watched an airship swaying gently in the breeze will be readily able to realise, only quite a small percentage of this little army of human anchors could have possibly been effective at any one moment.

### THE "VILLE DE PARIS" TO GO TO VERDUN.

As the sister airship to the lost "Patrie" will not be ready until February, the French Government has accepted an offer made by M. Deutsch de la Meurthe to send his airship, "Ville de Paris," immediately to Verdun.



THE R.F.C. FIRST IN THE THRIFT QUEUE.—Opening scene in an £18,000 Xmas pay out. The twenty-sixth annual "pay out" of the New Tabernacle Dividing Society took place this week, when nearly £18,000 was paid out to members. An R.F.C. man was the first recipient of a welcome Xmas box.



# INTERNATIONAL AIRCRAFT STANDARDS.

(Continued from page 1283.)

## 3S7—Specifications for Alloy Steel Bars and Billets. (200,000 lbs. per sq. in. Tensile Strength.)

**GENERAL.**—1. The general specifications, 1Gr, shall form according to their applicability, a part of these specifications.

**USE.**—2. This steel is to be used for gears.

**MATERIAL.**—3. The material for these bars shall be chosen from among the I. A. S. B. standard alloy steels listed below. The composition chosen shall be stated by the manufacturer or contractor, and is further limited as follows: Carbon, not over 0.50 per cent.; phosphorus, not over 0.03 per cent.; sulphur, not over 0.03 per cent.

**MANUFACTURE.**—4. (a) The steel shall be manufactured or at least finished by the electric furnace or crucible process.

(b) A sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

(c) The billets from which the bars are made are to be rough turned or chipped to remove all surface defects which might produce seams in the finished bars. No undercutting in chipping will be allowed.

**Heat Treatment.**—(d) The steel manufacturer shall state the heat treatment recommended to give the physical properties specified.

(e) If the bars are furnished in the heat-treated condition and the mechanical tests show that the heat treatment has not been correct, the bars may be re-treated at the option of the purchaser.

**WORKMANSHIP AND FINISH.**—5. (a) The bars are to be sound, commercially straight, free from pipes, laps, twists, seams, and damaged ends, and are to have a workmanlike finish. They are to be uniform in quality, within the stipulated margins of manufacture, capable of being turned and threaded readily and of taking a good finish.

(b) Any article may be rejected because of injurious defects or faults in manufacture at any time, notwithstanding that it has previously passed the physical and chemical tests; it shall be returned to the manufacturer at the latter's expense. This clause shall not be taken to apply to materials fabricated after export.

**PHYSICAL PROPERTIES AND TESTS.**—6. (a) The bars shall have the following physical properties:

**Tensile Test.**—(b) Minimum tensile strength, 200,000 lbs. per sq. in. (140.60 kg./mm.<sup>2</sup>); minimum yield point, 160,000 lbs. per sq. in. (112.48 kg./mm.<sup>2</sup>); minimum elongation in 2 in. (50.8 mm.) or proportional gauge length, 10 per cent.; minimum reduction of area, 35 per cent.

**Impact Test.**—(c) When impact-testing machines of the pendulum type are available, tests shall be carried out if required to determine the specific impact of rupture in foot-pounds (or in kilogram-metres). Results markedly lower than the average of this type of material will be sufficient cause for further investigation (or reheat treatment) of the material.

**SELECTION OF TEST SPECIMENS.**—7. Three bars of each size rolled from a heat shall be taken, and test pieces prepared in accordance with I.A.S.B. standards. Each test piece and the bar from which it is cut shall be stamped with an identifying number. Should any of the test pieces, after being heat treated in the manner recommended, fail to show the prescribed physical properties, new test pieces similarly identified shall be made from the same three bars. At the option of the purchaser, the steel manufacturer may recommend a different heat treatment for the second set of test specimens, and to that end he may make such tests as he desires from the remainder of the three bars taken for the tests. Should any of the three specimens taken for the final test fail to show the required physical properties, the bars of that heat of the size represented by the specimens shall be rejected.

**DIMENSIONS AND TOLERANCES.**—8. The dimensions and tolerances shall be those given by the specifications 3S11.

**DELIVERY, PACKING AND SHIPPING.**—9. (a) The bars may be delivered in the annealed or in the heat-treated condition.

(b) The steel manufacturer must stamp the heat number and the I.A.S.B. steel serial numbers on each bar of material furnished for this specification, where the bars are not less than 1½ sq. in. (968 sq. mm.) in cross section.

(c) Where bars are less than 1½ sq. in. (968 sq. mm.) in cross section and are not stamped with the heat and serial numbers, they shall be bundled into lots of not more than 150 lbs. (68 kg.) per bundle, and the heat number and the I.A.S.B. steel serial numbers must be stamped on a metal tag attached to each of the bundles.

## Chemical Composition of Standard Alloy Steels.

### NICKEL STEELS.

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulphur, maximum.	Nickel.	Chromium.
2335 ..	0.30-0.40	0.50-0.80	0.040	0.045	3.25-3.75	..

### NICKEL-CHROMIUM STEELS.

3140 ..	0.35-0.45	0.50-0.80	0.040	0.045	1.00-1.50	0.45-0.75
3240 ..	0.35-0.45	0.30-0.60	0.040	0.045	1.50-2.00	0.90-1.25
X3340 ..	0.35-0.45	0.45-0.75	0.040	0.045	2.75-3.25	0.70-0.95
3330 ..	0.25-0.35	0.30-0.60	0.040	0.045	3.25-3.75	1.25-1.75
3340 ..	0.35-0.45	0.30-0.60	0.040	0.045	3.25-3.75	1.25-1.75
X3440 ..	0.35-0.45	0.30-0.60	0.040	0.045	4.00-5.00	1.00-1.50

### CHROMIUM VANADIUM STEELS.

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulphur, maximum.	Chromium, minimum.	Vanadium, minimum.
6140 ..	0.35-0.45	0.50-0.80	0.040	0.045	0.80-1.10	0.15

## 3S8—Specifications for Alloy Steel Bars and Billets. (225,000 lbs. per sq. in. Tensile Strength.)

**GENERAL.**—1. The general specifications, 1Gr, shall form, according to their applicability, a part of these specifications.

**USE.**—2. This steel to be used for gears.

**MATERIAL.**—3. The material for these bars shall be chosen from among the I.A.S.B. standard alloy steels listed below. The composition chosen shall be stated by the manufacturer or contractor, and is further limited as follows: Carbon, not over 0.50 per cent.; phosphorus, not over 0.03 per cent.; sulphur, not over 0.03 per cent.

**MANUFACTURE.**—4. (a) The steel shall be manufactured or at least finished by the electric furnace or crucible process.

(b) A sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

(c) The billets from which the bars are made are to be rough turned or chipped to remove all surface defects which might produce seams in the finished bar. No undercutting in chipping will be allowed.

**Heat Treatment.**—(d) The steel manufacturer shall state the heat treatment recommended to give the physical properties specified.

(e) If the bars are furnished in the heat-treated condition and the mechanical tests show that the heat treatment has not been correct, the bars may be re-treated at the option of the purchaser.

**WORKMANSHIP AND FINISH.**—5. (a) The bars are to be sound, commercially straight, free from pipes, laps, cracks, twists, seams, and damaged ends, and are to have a workmanlike finish. They are to be uniform in quality, within the stipulated margins of manufacture, capable of being turned and threaded readily and of taking a good finish.

(b) Any article may be rejected because of injurious defects or fault in manufacture at any time; notwithstanding that it has previously passed the physical and chemical tests, it shall be returned to the manufacturer at the latter's expense. This clause shall not be taken to apply to materials fabricated after export.

**PHYSICAL PROPERTIES AND TESTS.**—6. (a) The bars shall have the following physical properties:

**Tensile Test.**—(b) Minimum tensile strength, 225,000 lbs. per sq. in. (158.18 kg./mm.<sup>2</sup>); minimum yield point, 180,000 lbs. per sq. in. (126.54 kg./mm.<sup>2</sup>); minimum elongation in 2 in. (50.8 mm.) or proportional gauge length, 9 per cent.; minimum reduction of area, 30 per cent.

**Impact Test.**—(c) When impact-testing machines of the pendulum type are available, tests shall be carried out if required to determine the specific impact work of rupture in foot-pounds (or in kilogram-metres). Results markedly lower than the average for this type of material will be sufficient cause for further investigation (or reheat treatment) of the material.

**SELECTION OF TEST SPECIMENS.**—7. Three bars of each size rolled from a heat shall be taken, and test pieces prepared in accordance with I.A.S.B. standards. Each test piece and the bar from which it is cut shall be stamped with an identifying number. Should any of the test pieces, after being heat treated in the manner recommended, fail to show the prescribed physical properties, new test pieces similarly identified shall be made from the same three bars. At the option of the purchaser, the steel manufacturer may recommend a different heat treatment for the second set of test specimens, and to that end he may make such tests as he

desires from the remainder of the three bars taken for the tests. Should any of the three specimens taken for the final test fail to show the required physical properties, the bars of that heat of the size represented by the specimens shall be rejected.

**DIMENSIONS AND TOLERANCES.**—8. The dimensions and tolerances shall be those given by the specifications 3S11.

**DELIVERY, PACKING AND SHIPPING.**—9. (a) The bars may be delivered in the annealed or in the heat-treated condition.

(b) The steel manufacturer must stamp the heat number and the I.A.S.B. steel serial numbers on each bar of material furnished for this specification, where the bars are not less than 1½ sq. in. (968 sq. mm.) in cross section.

(c) Where the bars are less than 1½ sq. in. (968 sq. mm.) in cross section and are not stamped with the heat and serial numbers, they shall be bundled into lots of not more than 150 lb. (68 kg.) per bundle and the heat number and the I.A.S.B. steel serial numbers must be stamped on a metal tag attached to each of the bundles.

*Chemical Composition of Standard Alloy Steels.*

**NICKEL STEELS.**

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulfur, maximum.	Nickel.	Chromium.
2335 ..	0.30-0.40	0.50-0.80	0.040	0.045	3.25-3.75	..

**NICKEL-CHROMIUM STEELS.**

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulfur, maximum.	Nickel.	Chromium.
3140 ..	0.35-0.45	0.50-0.80	0.040	0.045	1.00-1.50	0.45-0.75
3240 ..	0.35-0.45	0.30-0.60	0.040	0.045	1.50-2.00	0.90-1.25
X3340 ..	0.35-0.45	0.45-0.75	0.040	0.045	2.75-3.25	0.70-0.95
3340 ..	0.35-0.45	0.30-0.60	0.040	0.045	3.25-3.75	1.25-1.75
X3440 ..	0.35-0.45	0.30-0.60	0.040	0.045	4.00-5.00	1.00-1.50

**CHROMIUM VANADIUM STEELS.**

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulfur, maximum.	Chromium.	Vanadium, minimum.
6140 ..	0.35-0.45	0.50-0.80	0.040	0.045	0.80-1.10	0.15

**3Ni—Specifications for Gun-Metal Castings.**

**GENERAL.**—1. The general specifications, 1G1, shall form, according to their applicability, a part of these specifications.

**MATERIAL.**—2. The chemical composition shall be as follows: Copper, 87 to 89 per cent.; tin, 9 to 11 per cent.; zinc, 1 to 3 per cent.; iron, 0.2 per cent., maximum; lead, 0.2 per cent., maximum.

**MANUFACTURE.**—3. (a) The material must be made from lake or electrolytic copper according to the I.A.S.B. specification 2N2 and pig tin having a purity of at least 99 per cent.

(b) No scrap shall be used, except such as may accumulate in the manufacturer's plants from material of the same composition and of their own make.

**WORKMANSHIP AND FINISH.**—4. Castings must be homogeneous and free from shrinkage cracks, spongy spots, blowholes, and foreign matter. Any castings developing defects in machining must be replaced by the manufacturer. The full weight of material in the original casting must be returned by the purchaser for each replacement.

**PHYSICAL PROPERTIES AND TESTS.**—5. Gun-metal castings shall have the following physical properties: Minimum tensile strength, 30,000 lb. per sq. in. (21.09 kg./mm.<sup>2</sup>); minimum yield point, 15,000 lb. per sq. in. (10.55 kg./mm.<sup>2</sup>); minimum elongation, 15 per cent. in 2 in. (50.8 mm.).

**SELECTION OF TEST SPECIMEN.**—6. (a) The test bars shall be cast to size either from the casting, if the size of the same will permit, or from a separate block. The test bar shall be connected with the casting or block by a ½-in. (3.18 mm.) gate running the entire length of the test bar.

(b) The total length of the test bar shall be at least 6 in. (152.4 mm.), the length between shoulders 2½ in. (69.85 mm.), the diameter of the reduced section approximately 0.57 in. (14.48 mm.) for a length of 2½ in. (57.15 mm.).

(c) This test bar, when detached from the casting, shall be machined according to the I.A.S.B. standard test bar 0.505 in. (12.83 mm.) in diameter.

(d) The test bars and casting shall have the heat number cast or stamped on the pieces.

(e) At least two test bars shall be cast from each heat.

(f) One test shall be made to represent each heat, but in case of a flaw in the test bar or a break outside of the middle third of the gauge length, further tests may be made on extra test pieces, as provided for in the foregoing paragraph.

**DIMENSIONS AND TOLERANCES.**—7. All castings must be true to pattern with correctly placed cores.

**3S9—Specifications for Alloy Steel Bars and Billets for Case Hardening.**

(165,000 lb. per sq. in. Tensile Strength.)

**GENERAL.**—1. The general specifications, 1G1, shall form, according to their applicability, a part of these specifications.

**MATERIAL.**—2. The material for these bars shall be chosen from among the I.A.S.B. standard alloy tests listed below. The composition chosen shall be stated by the manufacturer or contractor; it is further limited as follows: Carbon, not over 0.25 per cent.

**MANUFACTURE.**—3. (a) The steel shall be manufactured or at least finished by the open-hearth, electric furnace, or crucible process.

(b) A sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

(c) The billets from which the bars are made are to be rough-turned or chipped to remove all surface defects which might produce seams in the finished bar. No undercutting in chipping will be allowed.

(d) The steel manufacturer shall state the heat treatment recommended for case hardening this steel and to give the physical properties specified.

**WORKMANSHIP AND FINISH.**—4. (a) The bars are to be sound, commercially straight, free from pipes, laps, cracks, twists, seams, and damaged ends, and are to have a workmanlike finish. They are to be uniform in quality, within the stipulated margins of manufacture, capable of being turned and threaded readily and of taking a good finish.

(b) Any article may be rejected because of injurious defects or faults in manufacture at any time, notwithstanding that it has previously passed the physical and chemical tests; it shall be returned to the manufacturer at the latter's expense. This clause shall not be taken to apply to materials fabricated after export.

**PHYSICAL PROPERTIES AND TESTS.**—5. The bars shall have the following physical properties:

**Tensile Tests.**—(a) Minimum tensile strength, 165,000 lb. per sq. in. (116.00 kg./mm.<sup>2</sup>); minimum yield point, 150,000 lb. per sq. in. (105.45 kg./mm.<sup>2</sup>); minimum elongation in 2 in. (50.8 mm.) or proportional gauge length, 14 per cent.

**Hardness Test.**—(b) After carbonising, hardening, and tempering, the case must show a minimum Shore scleroscope hardness number of 75.

**Impact Test.**—(c) When impact-testing machines of the pendulum type are available, tests shall be carried out if required to determine the specific impact work of rupture of the core in foot-pounds (or kilogram-metres). Results markedly lower than the average for this type of material will be sufficient cause for further investigation (or reheat treatment) of the material.

**SELECTION OF TEST SPECIMENS.**—6. Three bars of each size rolled from a heat shall be taken and test pieces prepared in accordance with the I.A.S.B. standards. Each test piece and the bar from which it is cut shall be stamped with an identifying number. Should any of the test pieces, after being heat treated in the manner recommended by the steel manufacturer, fail to show the prescribed physical properties, new test pieces similarly identified shall be made from the same three bars. At the option of the purchaser, the steel manufacturer may recommend a different heat treatment for the second set of test specimens, and to that end he may make such tests as he desires from the remainder of the three bars taken for the tests. Should any of the three specimens taken for the final tests fail to show the required physical properties, the bars of that heat of the size represented by the specimens shall be rejected.

**DIMENSIONS AND TOLERANCES.**—7. The dimensions and tolerances shall be those of the specifications 3S11.

**DELIVERY, PACKING AND SHIPPING.**—8. (a) The bars shall be delivered in the annealed state.

(b) The bars shall in general be grouped in bundles weighing not more than 250 lb. (113.4 kg.), unless otherwise agreed between manufacturer and purchaser; the heat number and the I.A.S.B. steel serial numbers shall be plainly marked on a metal tag attached to each bundle. If bars are not so grouped and bundled, each bar shall be plainly marked with the heat number and the I.A.S.B. steel serial number.

*Chemical Composition of Standard Alloy Steels.*

**NICKEL STEELS.**

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulfur, maximum.	Nickel.	Chromium.
2315 ..	0.10-0.20	0.30-0.60	0.040	0.045	3.25-3.75	..
2320 ..	0.15-0.25	0.30-0.60	0.040	0.045	3.25-3.75	..

**NICKEL-CHROMIUM STEELS.**

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulfur, maximum.	Nickel.	Chromium.
3120 ..	0.15-0.25	0.30-0.60	0.040	0.045	1.00-1.50	0.45-0.75
3215 ..	0.10-0.20	0.30-0.60	0.040	0.045	1.50-2.00	0.90-1.25
X3315 ..	0.10-0.20	0.30-0.60	0.040	0.045	2.75-3.25	0.70-0.95
3315 ..	0.10-0.20	0.30-0.60	0.040	0.045	3.25-3.75	1.25-1.75

**CHROMIUM VANADIUM STEELS.**

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulfur, maximum.	Chromium.	Vanadium, minimum.
6120 ..	0.15-0.25	0.30-0.60	0.040	0.045	0.60-0.90	0.15



When electric or crucible furnace steel is specified, the maximum allowable percentages of phosphorus and sulphur may, at the option of the purchaser, be limited to 0.03 per cent.

### 3S10—Specifications for Alloy Steel Bars and Billets for Case-Hardening.

(180,000 lb. per sq. in. Tensile Strength.)

**GENERAL.**—1. The general specifications, 1G1, shall form, according to their applicability, a part of these specifications.

**MATERIAL.**—2. The material for these bars shall be chosen from among the I.A.S.B. standard alloy steels listed below. The composition chosen shall be stated by the manufacturer or contractor; it is further limited as follows: Carbon, not over 0.20 per cent.

**MANUFACTURE.**—3. (a) The steel shall be manufactured or at least finished by the open-hearth, electric furnace, or crucible process.

(b) A sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

(c) The billets from which the bars are made are to be rough turned or chipped to remove all surface defects which might produce seams in the finished bar. No under-cutting in chipping will be allowed.

(d) The steel manufacturer shall state the heat treatment recommended for case-hardening this steel and to give the physical properties specified.

**WORKMANSHIP AND FINISH.**—4 (a) The bars are to be sound, commercially straight, free from pipes, laps, cracks, twists, seams, and damaged ends, and are to have a workmanlike finish. They are to be uniform in quality, within the stipulated margins of manufacture, capable of being turned and threaded readily and of taking a good finish.

(b) Any article may be rejected because of injurious defects or faults in manufacture at any time notwithstanding that it has previously passed the physical and chemical tests; it shall be returned to the manufacturer at the latter's expense. This clause shall not be taken to apply to materials fabricated after export.

**PHYSICAL PROPERTIES AND TESTS.**—5. The bars shall have the following physical properties:

**Tensile Test.**—(a) Minimum tensile strength, 180,000 pounds per square inch (126.54 kg./mm.<sup>2</sup>); minimum yield point, 170,000 lb. per sq. in. (119.51 kg./mm.<sup>2</sup>); minimum elongation in 2 in. (50.8 mm.) or proportional gauge length, 12 per cent.

**Hardness Test.**—(b) After carbonising, hardening, and tempering, the case must show a minimum Shore scleroscope hardness number of 75.

**Impact Test.**—(c) When impact-testing machines of the pendulum type are available, tests shall be carried out if required to determine the specific impact work of rupture of the core in foot-pounds (or kilogram-metres). Results markedly lower than the average for this type of material will be sufficient cause for further investigation (or reheat treatment) of the material.

**SELECTION OF TEST SPECIMENS.**—6. Three bars of each size rolled from a heat shall be taken and test pieces prepared in accordance with the I.A.S.B. standards. Each test piece and the bar from which it is cut shall be stamped with an identifying number. Should any of the test pieces, after being heat treated in the manner recommended by the steel manufacturer, fail to show the prescribed physical properties new test pieces similarly identified shall be made from the same three bars. At the option of the purchaser, the steel manufacturer may recommend a different heat treatment for the second set of test specimens, and to that end he may make such tests as he desires from the remainder of the three bars taken for the tests. Should any of the three specimens taken for the final tests fail to show the required physical properties, the bars of that heat of the size represented by the specimens shall be rejected.

**DIMENSIONS AND TOLERANCES.**—7. The dimensions and tolerances shall be those of the specifications 3S11.

**DELIVERY, PACKING AND SHIPPING.**—8. (a) The bars shall be delivered in the annealed state.

(b) The bars shall in general be grouped in bundles weighing not more than 250 lb. (113.4 kg.), unless otherwise agreed upon between manufacturer and purchaser; the heat number and the I.A.S.B. steel serial numbers shall be plainly marked on a metal tag attached to each bundle. If bars are not so grouped and bundled, each bar shall be plainly marked with the heat number and the I.A.S.B. steel serial number.

### Chemical Compositions of Standard Alloy Steels.

#### NICKEL-CHROMIUM STEELS.

Number.	Carbon.	Manganese.	Phosphorus, maximum.	Sulphur, maximum.	Nickel.	Chromium.
X3315 ..	0.10-0.20	0.30-0.60	0.040	0.045	2.75-3.25	0.70-0.95
3315 ..	0.10-0.20	0.30-0.60	0.040	0.045	3.25-3.75	1.25-1.75

When electric or crucible furnace steel is specified, the maximum allowable percentages of phosphorus and sulphur may, at the option of the purchaser, be limited to 0.03 per cent.

### 3N5—Specifications for Naval Brass or Equivalent Alloy Sheet.

**GENERAL.**—1. The general specifications, 1G1, shall form, according to their applicability, a part of these specifications.

**MATERIAL.**—2. (a) The chemical composition of the brass shall be as follows:

	Per cent.
Copper ..	59 to 63
Tin ..	0.5 to 1.5
Iron, maximum ..	0.10
Lead, maximum ..	0.3
Zinc ..	Remainder

(b) Samples for analysis shall be taken by boring completely through the plate at various points across both ends.

**MANUFACTURE.**—3. (a) The material must be made from lake or electrolytic copper according to I.A.S.B. specifications 2N2 and virgin spelter of A or B grade, according to I.A.S.B. specifications 2N3.

(b) No scrap shall be used, except such as may accumulate at the manufacturer's plants from material of the same composition and of their own make.

**WORKMANSHIP AND FINISH.**—4. The material shall be free from all injurious defects. It shall be clean, straight, smooth, shall lie flat, and shall be of uniform colour, quality, and size.

**PHYSICAL PROPERTIES AND TESTS.**—5. (a) The sheets shall show the following physical properties:

**Tensile test.**—(a) Plates less than  $\frac{1}{2}$  in. (12.7 mm.) thick and less than 30 in. (762 mm.) wide shall have a minimum tensile strength of 56,000 lb. per sq. in. (39.37 kg./mm.<sup>2</sup>), minimum yield point of 28,000 lb. per sq. in. (19.68 kg./mm.<sup>2</sup>), minimum elongation of 30 per cent. in 2 in. (50.8 mm.); over  $\frac{1}{2}$  in. (12.7 mm.) thick, minimum tensile strength of 56,000 lb. per sq. in. (39.37 kg./mm.<sup>2</sup>), minimum yield point of 27,000 lb. per sq. in. (18.98 kg./mm.<sup>2</sup>), minimum elongation of 35 per cent. in 2 in. (50.8 mm.); less than  $\frac{1}{2}$  in. (12.7 mm.) thick and over 30 in. (762 mm.) wide, minimum tensile strength of 54,000 lb. per sq. in. (37.96 kg./mm.<sup>2</sup>), minimum yield point of 27,000 lb. per sq. in. (18.98 kg./mm.<sup>2</sup>), minimum elongation of 35 per cent. in 2 in. (50.8 mm.).

**Bending test.**—(b) Strips cut from plates shall stand being bent cold through an angle of 180 deg. in any direction to a radius equal to the thickness of the plate without fracture.

**SELECTION OF TEST SPECIMENS.**—6. One tensile-test specimen, and one bending-test specimen shall be taken for each lot of 500 lb. (226.8 kg.) or fraction thereof. If any test specimen breaks outside of the middle third of the gauge length a retest will be allowed.

**DIMENSIONS AND TOLERANCES.**—7. (a) The weight or thickness shall not vary more than 5 per cent. from that specified. Thickness will be specified in decimals of an inch or millimetre, and shall correspond to the ordinary gauge numbers.

(b) For wide sheets or plates above 48 in. (1,219 mm.) to and including 60 in. (1,524 mm.) a tolerance of 5 per cent. over or 7 per cent. under gauge or weight will be allowed.

(c) For extra wide sheets or plates above 60 ins. (1,524 mm.) in width the tolerance may be 5 per cent. over or 8 per cent. under gauge or weight.

(d) For the purpose of calculating weights, &c., the specific gravity of the alloy shall be taken as 8.404 at 20° C., or 0.3036 lb. per cu. in. (8.404 grams/cm.<sup>3</sup>).

**DELIVERY, PACKING AND SHIPPING.**—8. (a) Plates and sheets shall be cut to the required dimensions and shall be ordered in as narrow widths as can be used.

(b) The following will be considered stock lengths for naval brass sheets when ordered in 10 ft. (3,048 mm.) lengths; 40 per cent. in weight may be in 8 to 10 ft. lengths (2,438 to 3,048 mm.), 30 per cent. in weight may be in 6 to 8 ft. lengths (1,829 to 2,438 mm.), 20 per cent. in weight may be in 4 to 6 ft. lengths (1,219 to 1,829 mm.), 10 per cent. in weight may be in 2 to 4 ft. lengths (610 to 1,219 mm.).

(c) No lengths less than 2 ft. (610 mm.) will be accepted, and the total weight of all pieces in lengths less than 10 ft. (3,048 mm.) must not exceed 40 per cent. in any one shipment.

(To be continued.)

# Personals

## Casualties.

Captain CHARLES HENRY GIMINGHAM, Hertford Regiment, attached R.F.C., was the younger son of Mrs. Gimmingham Christmas, of Harpenden, and the late Charles Henry Gimmingham. He was educated at Aldenham School, and became a chartered accountant, passing his final examination in November, 1914. In the same month he enlisted as a despatch rider in the Royal Engineers, and obtained a commission in the Hertford Regiment in the summer of 1915, proceeding to the front in the autumn of that year. After an accident to his ankle which rendered him temporarily incapable of infantry work he was attached to the R.F.C., and joined a kite balloon section at the front, where for some weeks he did the work of an observer. He then came home for training in free ballooning, and in October, 1916, was sent out to another front with a draft for a kite balloon section. For the last six months he was in command of his section. He was killed on November 9th, aged 26.

Lieutenant CHRISTOPHER GODFREY GUY, Northamptonshire Regiment, attached R.F.C., who died of wounds on August 12th, was the only son of the Rev. F. Godfrey Guy, formerly Conduct of Eton College, and vicar of Manea, Cambridgeshire, and Mrs. Guy, of 38, Christchurch Road, Bournemouth. He was 23 years of age, was born at Eton in 1893, and educated at Gore Court, Sittingbourne, and at Eton, having gained a foundation scholarship in 1907. In December, 1912, he gained an open exhibition for classics at King's College, Cambridge, and went into residence in October, 1913, having decided to take up the study of medicine. In 1914 he received his commission, and soon was promoted to lieutenant, and then temporary captain. In July, 1915, he went with his regiment to Gallipoli, and in the following October was invalided home. In the autumn of 1916 he became attached to the R.F.C., and after completing his training he received orders to go to the front as a scout pilot in July of this year. On August 11th when out on patrol he was severely wounded, taken prisoner, and on the next day died in a field hospital.

Lieutenant CYRIL L. HAINS, R.N.A.S., who was missing on May 26th, and now officially reported killed, was the son of Mrs. Littlehales-Barker, Salmon Arm, B.C., and the late Dr. Hains, of Totnes, Devon, and Old Brompton, Chatham. His age was 21.

Lieutenant WILLIAM MICHAEL DASHWOOD STIRLING STRETTELL, Highland L.I., attached R.F.C., was a student of medicine at St. Andrews University, and a keen member of the O.T.C. there. On the outbreak of war he offered his services, and was granted a commission on August 15th, 1914, in the Highland L.I. (S.R.), being promoted lieutenant in 1915. He left for France early in May, 1915, where he was attached to the K.O.S.B. He was wounded in the arm in the fighting near Ypres, and was invalided home. While still unfit for general service he served with the 1st Garrison Battalion the Royal Scots, in both Lemnos and Egypt. He joined the R.F.C. in the autumn of 1916, and some months later acted as assistant instructor in flying at the Central Flying School, Upavon. He was again sent to the front on September 29th last, and was killed on November 28th, aged 24. He was the only son of the late George W. Strettell (Indian Forests) and of Mrs. Strettell, of Roanhill, Kincardine, Fife.

Lieutenant JOHN GARDNER WHITE, Scottish Rifles (Cameronians), attached R.F.C., who was killed on August 26th whilst "on a special mission" over the German lines, aged 20, was the second son of the Rev. John White and Margaret White, The Barony, Glasgow.

Captain HENRY HALL GRIFFITH, R.F.C., killed in an aeroplane accident in Kent on November 2nd, aged 26, was the second son of Mr. and Mrs. Arthur Foster Griffith, of 59, Montpelier Road, Brighton. From Brighton College he went to Christ's College, Cambridge, where he rowed in the college boat, and was an active member of the O.T.C., Engineer Section. He took his degree in 1912, and was articled to his father, but shortly afterwards met with a severe accident to his knee which greatly incapacitated him for nearly four years. Immediately on the outbreak of war he was summoned to Chatham (with the rest of his O.T.C. comrades) to join the Scouts in the Expeditionary Force, but was rejected owing to his knee. His repeated attempts to join special sections were unsuccessful, and he went to Hendon, learnt to fly, and was then accepted for the F.R.C. He obtained his "Wings" and

went to France as a pilot in October, 1916. In his second flight over the German lines he and his observer were attacked by six enemy aeroplanes. They destroyed one, drove down another, and broke up the rest, his observer being seriously wounded, but a bullet through his petrol tank forced him to make the best of his way back, and in spite of the fact that his under-carriage had been shot to pieces he made a perfect landing just inside our lines. After nine months of active service, chiefly on observation and photographing work, he returned to England last July. He was serving at an instruction camp when he was killed. His younger brother, Midshipman William Llewelyn Griffith, R.N., was killed in H.M.S. *Indefatigable* in the Battle of Jutland.

Amidst every token of sympathy the funeral took place at Gainsborough Cemetery, Lincolnshire, of Lieutenant JOHN AUGUSTUS HARMAN, R.F.C., who was accidentally killed whilst flying in Lincolnshire (where he was stationed and had a host of friends), at the early age of 24. The deceased officer, who was the eldest son of Mr. John Eustace Harman (Barrister-at-Law of Lincoln's Inn) and Mrs. Harman, of 45, Onslow Square, London, was educated at Edgeborough, Guildford and Uppingham School. In the summer of 1915 he came from Ceylon, where he was on a tea plantation, and received a commission in the A.S.C., with which he served at Sulva Bay, Egypt and Salonica. At the beginning of 1917 he joined the R.F.C., and got his wings in Egypt. He returned home in June of this year, and was attached to the home defence squadron. His younger brother, Lieutenant C. E. Harman, was wounded and captured at the Battle of Loos in September, 1915, and is a prisoner of war in Germany. The funeral was fully military, and started from the headquarters of the 33rd Squadron R.F.C., Lincoln.

Second Lieutenant JOHN THOMAS GORDON HIGGINSON, R.F.C., the second son of Mr. and Mrs. W. Higginson, 7, Winchester Avenue, Leicester, aged 19 years, was accidentally killed at Grantham on November 1st. He was educated at the Royal Grammar School, Colchester, and at the Alderman Newton School, Leicester. He was an engineer premium apprentice at the London and North-Western Railway Locomotive Works at Crewe, having been there for 18 months, when he felt the call to the youth of England, and volunteered for the R.F.C. in April last. He was a Cadet until August, when he was commissioned. The interment took place on November 5th at Crewe. Mr. and Mrs. Higginson's eldest son, Second Lieutenant William Clifton Vernon Higginson, R.F.C., who has been in France since September 24th, a flying officer, is now reported missing on the 20th inst., and they are very distressed indeed. This son was a medical student at St. Bartholomew's Hospital, and an undergraduate of London University, matriculating in 1915, and taking his M.B. (first examination) in July, 1916. He joined the R.F.C., and was commissioned in April last, being previously in the London University O.T.C. (Medical Unit) and afterwards Inns of Court O.T.C.

Lieutenant R.C. JENKINS, R.F.C., who died at Gosport on December 2nd, as the result of an accident whilst flying, was the second son of Mr. and Mrs. Ed. E. Jenkins, Cambridge House, Cambridge Road, East Twickenham.

Second Lieutenant GEORGE ERNEST MARTIN, R.F.C., who was accidentally killed whilst flying on November 28th, aged 25, was the son of the late Frederick Ernest Martin, of Upper Norwood, and nephew of Mr. and Mrs. H. J. Martin, of Little Baddow.

## Missing.

Lieutenant G. B. CROLE, R.F.C., officially reported missing, is the well-known Oxford Rugby football Blue and golfer. He was educated at Edinburgh Academy and University College, Oxford, and gained his football colours at school. On going up to Oxford he was given his Blue, and played three-quarter back against Cambridge in the last Rugby match before the war. He also represented Oxford against Cambridge in the golf matches of 1913 and 1914. In the early stages of the war he served as second lieutenant in the Dragoon Guards, but transferred to the Royal Flying Corps, winning the Military Cross in September last.

## Married.

On December 6th, at All Souls' Church, Portland Place, Captain OSBERT M. GREG, Royal Warwicks, attd. R.F.C., elder son of Mr. and Mrs. Herbert Greg, of Macclesfield, was married to EILEEN, elder daughter of Mr. and Mrs. H. H. WATKINS, of Mumbles, Glamorgan.



On December 6th at the Chapel Royal, Savoy, Lieutenant F. BRITTON LUGET, R.F.C., son of J. B. Luget, of Balham, was married to DOROTHY, only daughter of the late William STIMPSON and Mrs. Stimpson, of Southsea.

On December 4th at the Registry Office, Paddington, and afterwards at St. James's, Piccadilly, Lieutenant CHARLES TOM SIGISMUND MENDEL, Devon Regiment, and R.F.C., elder son of Mr. and Mrs. S. F. Mendl, of 17, Hyde Park Street, was married to BERYL ALTHEA (BETTY), younger daughter of the late R. C. THOMAS, of The Court, Merthyr Tydfil, and of Mrs. J. Baker White, The Cottage, Shaldon, Devon.

#### To be Married.

The marriage arranged between Captain LACHLAN LOUDOUN MACLEAN, Indian Infantry and R.F.C., and PHYLLIS AILEEN MORRIS, eldest daughter of the late Lieutenant Colonel Godfrey Morris, 8th Gurkhas, and Mrs. Morris, of 98, Philbeach Gardens, will take place at St. Peter's, Cranley Gardens, on December 15th at 2.30.

A marriage has been arranged between Flight-Commander W. G. MOORE, D.S.C., R.N., second son of the late W. H. Moore and of Mrs. Moore, of Woodfield, Malvern Wells, and HAYDÉE, daughter of Mr. and Mrs. FRED BECKER, of Sutton Hall, Heston, Hounslow, and Don Cottage, Aberdeen.

The engagement is announced between Lieutenant REGINALD H. SCHERK, Reserve Canadians and R.F.C., elder son of Dr. and Mrs. F. H. Scherk, of Balmy Beach, Toronto, and MOLLY, third daughter of the late Mr. T. HARRIS and Mrs. Harris, of Ashford, Kent.

A marriage has been arranged, and will shortly take place between Captain CHARLES MOLYNEUX SMITH, M.C., R.F.C., eldest son of Mr. and Mrs. Arthur Smith, of Glenavon, Oaklands Road, Bedford, and BARBARA FULLER, widow of Captain W. B. Fuller, Queen's Regiment, and daughter of Major and Mrs. S. A. Pixley, of Maybury Knowle, Woking.



## COMMERCIAL AERONAUTICS.\*

By Lieut.-Colonel MERVYN O'GORMAN, C.B., D.Sc.

(Concluded from page 1290.)

*Research.*—It is possible that someone will question the need for research and for State endowment thereof; it may be said that we are well on and can now trust to practical developments, since root and branch retrenchment of expense is called for. This is a complete *non sequitur*. If cheap progress is wanted, the cost of progress is enormously reduced by making and testing models 2 ft. wide instead of making structures of a 100-ft. span. The ratio of cost is as £10,000 to £50, and it is the £50 scheme which I am advocating. I cannot give a list of researches, but ask you to consider the following examples. We need the scale corrections from model parts to full size; we need to test propulsive mechanisms, without building them; we must know the value of new wing sections; of reflexed wings; of hinging the flaps for controls; we must, in order to get any aeroplane stable, know the movement of the centre of pressure on the wings when the attitude of flight is varied; we must study the effect of vibration on structural parts, &c.

We are aware that the great utility of aerial travel is speed, that the great enemy of speed is head resistance, and we must be able by simple model tests to forecast the speed which will be attained by a given design. We must be able to know, before we introduce a variation in design, the amount of economy of resistance which can be made by altering structural parts. All this class of work can be effected in the wind tunnel, and already most serious aeronautical construction firms are equipping themselves with a wind tunnel. Probably the greatest value of such equipment is its educational effect. The wind tunnel has fought its way to the front, in spite of much opposition, and it is still to be recognised that unless its indications are interpreted by skilled persons grave blunders will be made, but this in no wise detracts from its utility when properly employed.

We are aware that the thermal efficiency of engines employed on aircraft is as high, in spite of their small size and weight, as the efficiency of Diesel engines giving thousands of horsepower. Yet this figure is only 30 per cent. and by research alone can we hope to obtain an extension of this percentage. The study of airscrew efficiency, the effect upon it of the body, the means for making airscrews smaller than they are at present, and thereby simplifying the whole outline of an aeroplane, is a matter which research must tackle. The use of new alloys, of new methods of totally enclosing the flyer in an aeroplane, new methods of housing the landing gear, so as to get rid of its head resistance, the protection of the fabric of the wings from disintegration by ozonisation due to actinic light, all these and countless more matters can only be economically and expeditiously studied in laboratories equipped for the purpose, they will effect enormous economies in aeronautical upkeep, and aero research must be pressed on and financed after the war.

Broadly, it may be said that air transport will not develop save by taking a line of footprints given by research. To say that we want it, does not by any means ensure that it will proceed apace as it should. Research of various kinds is remunerative in two different ways: (a) quickly; and (b) eventually. Those studies which conduce to (b) rarely produce (a) a quick return. On the other hand, researches which afford us (a) are very likely indeed to be remunerative both quickly and eventually.

If we now subdivide the various researches which might forward aeronautics into two other classes—those (a) which result in some proprietary advantage to the inventor, and those (b) which have a general effect on progress, and which are not susceptible of being privately protected—we find that there is every inducement to the research worker to concentrate upon the class of improvement which I have called (a) in each of the above pairs of groups, that is to say the device which can both be made proprietary and which is remunerative quickly.

This must, unless we are very foreseeing and courageous, operate to deflect research workers from the other and frequently much more important class of study, viz., those which are of *general* application and those which are eventually of great money value to the whole of the industry, whether of construction or of transport.

Patent laws stimulate advancement by providing that there shall be a reward, and that all and sundry shall not be able to possess themselves of the fruits of one man's labour and thereby dispossess him. Means must be devised for securing that the British industry as a whole shall not be tempted to exclude from its study the great groups which I have classed as (b), which are so frequently not protectible by patent; and this business falls naturally to the new Department of Scientific and Industrial Research, who will no doubt find the hearty co-operation of the Society of British Aircraft Constructors and the Aeronautical Society. It is for the public to see that the determination towards progress exists, and then the outcome will first of all be the necessary funds, and thereafter the harvest of results and economies.

The Air Board has formed a Civil Aerial Transport Committee, which is engaged in considering these and most of the other matters dealt with in any such discussion as this, and if they recommend active steps to be taken, let us hope that there will be firm public support for any expenditure and assistance which shows proper foresight, always with the considered approval of the new Air Minister.

*Education.*—It is more than probable that by far the most effective step towards industrial peace, with which is bound up much more than ever the healthy development of our aerial fleet, is education, and this aspect of the matter forces us to include what is sometimes overlooked in technical circles when speaking of education—a good foundation of sociological and ethical subjects, as well as technical information. Perhaps one of the most important reasons for developing this side of education is that it will give the average reader a more critical outlook upon the average newspaper, and its somewhat unguarded statements. The effect of this critical outlook will no doubt be that a far higher technical standard and a more cautious statement of alleged facts will be developed and in this way the educational effect of the press will react, to further the educational standards. It will not, we hope, be possible, a few years after the passage of Mr. Fisher's Act, for any person who pretends to a hearing to claim that there is a pool of wealth of limited total from which each and several draw as much as they can. That illusion is the foundation of the impression that the employees suffer by the employer being successful, and we shall all gradually come to accept that by restricting the production of wealth we diminish the chance we individually have of being wealthy.

The indirect abolition by Mr. Fisher's Act of the blind-alley occupations, will have also the effect (since we have decided to be governed by a body which includes many of those who live blindly in blind alleys at present), that a more farseeing electorate will have charge of our destinies. So far as the hand-workers in aircraft construction are concerned, they do not differ from the engineering trades generally, and the educational scheme which is good for the skilled fitter or carpenter is good for the aircraftsman. In the higher branches, e.g., the aeronautical designer, what is first wanted is a good engineering and sociological education, to which are to be superadded the specialities of his calling, a business largely to be achieved by familiarity in college or university with the work of the wind tunnel and whirling arm.

**Routes.**—One of the things wanted now is some enquiry made experimentally by actual flight for the purpose of determining the best aircraft trader and postal routes which may be useful and eventually payable. London-Paris has been suggested, with extension to Marseilles, Turin and Egypt. Links between capitals have also been spoken of, and links with India and South Africa, &c. Short runs will probably come first. In all short distance runs the problem is complicated when the existing rail and steam facilities compete. There is a marked advantage for aircraft every time that transshipment of any kind occurs on the ordinary means of transit. This favours London-Paris and London-Dublin, for example. Similarly, and for similar reasons, whereas no great advantage might be gained by a London-Glasgow route, where the train travels at fifty miles per hour, and the journey can easily be done during the lost hours of the night without the traveller being roused from his sleeping berth, we shall find that cross-country journeys, those involving changes of trains, waiting at stations for connections, will be instantly eclipsed in comfort and speed by aerial travel and aerial mail deliveries. One could suggest Cardiff and Newcastle, or the like.

I do not think that much is to be gained by suggesting routes at the present moment, unless we propose to permit a few machines to be withdrawn from war service, and then by using a few pilots who are for one reason or another not fit for war service, explore the practical possibilities of such transport. I think it far better to start by carrying newspapers and letters and packets rather than passengers, at first, for every reason. The routes will be unknown to the pilots, their experience may perhaps not be great—the advertisement expense needed to summon passengers to support the trial cannot usefully be made in war time, and generally, it is not desirable, save in exceptional cases, to expend petrol for personal travel, or to expend money in adapting designs to passengers' comfort. Yet if this comfort were omitted, a false impression of the facilities to be afforded would easily get spread broad.

I do not know whether certain types, whose performance is below the ever-rising requisites for war, could be made

available, but I should have thought that with good will they could be managed, and if so, the experiments made in war time would help us to start *quickly*, on the declaration of peace, that which might eventually help to create orders—only a few it is true, but still a small fraction of what is wanted for the maintenance of the production factories.

**Speed.**—I am inclined to endorse Mr. Holt Thomas's view that, if we consider the average wind speed as thirty miles per hour, sometimes with us and sometimes against, we shall need machines whose own air speed is 120 miles per hour, in the case when there is any competition with other means of transport.

On cross-country journeys far lower speeds will be vastly faster than the existing systems, and will at once command attention.

As we know 120 miles per hour is a very ordinary speed to-day for aircraft, and offers no technical difficulties in alighting—indeed, Captain Green's interesting forecast, under certain conditions which he laid down, of an aeroplane to travel at 240 miles per hour, did not appear to raise any feeling of doubt or hesitancy at the Aeronautical Society about three weeks ago—though a similar audience in 1911 was very sceptical about the advisability of introducing, even for military purposes, my proposed speed of seventy-two miles per hour. This gives us an idea of the changes which have gone on in men's minds by legitimate extrapolations from the actual achievements with which they are familiar.

I have nearly finished, but before doing so I must once more reiterate that the most hopeful estimate for immediate aircraft transport and travel does not save the situation. There must be Governmental action to maintain the country's productivity and designing capacity for military and naval aircraft in the first place, and as the mainstay of the country's factory organisation.

In conclusion, it is only half a truth to say with Frederick List, "The sea is the high street of the earth. The sea is the parade ground of the nations. The sea is the arena for the display of strength and enterprise of all the nations." There is now the air. A great instrument of power tending to peace and usefulness and good will can be designed in a week, if only a British, a French, an American, an Italian plenipotentiary could be empowered to sit round a table. That instrument is the aerial way. Its regulations must not be founded now upon speculation, they must be evolved later upon experience.

All the allied nations desire the same thing, all are agreed that just as in time of peace we must prepare for the catastrophe of war—so in war we must prepare our thoughts and plans for cataclysm of peace. The word is used advisedly, for a very sinister situation will develop in the world of aircraft during the hiatus which first was publicly indicated, I think, by myself, in the discussion on Mr. Holt Thomas's paper before the Aeronautical Society, and which Lord Cowdray himself promised to make every effort to bridge.

## Fatal Accidents.

A VERDICT of "Accidental death" was returned at an inquest at Westminster, on December 7th, on 2nd Lieut. T. B. Pritchard, R.F.C., who died on December 5th, from injuries received in an aeroplane accident on November 20th.

## Two Gotha Raiders Wrecked.

It would appear that in addition to the two Gotha raiders which were brought down in England a further two were destroyed as the result of colliding together while flying near Gentbrugge, on their homeward journey. The machines, according to a report from Amsterdam, were destroyed and the crews killed.

## Putting "L 29" to Good Use.

INSPIRED by the British idea of using a Tank as a dépôt for the sale of War Bonds, the French, on December 8th, opened a loan office in the car of the Zeppelin "L 29," captured at Bourbonne-les-Bains. A large crowd of people anxious to have their scrip stamped with the Zeppelin stamp passed through an avenue of captured guns to the Zeppelin relics, in front of which is an aeroplane flown by the late Capt. Guynemer. A further privilege accorded to subscribers to the loan is a peep at Tank 686.

## Airship Crosses Mediterranean.

ACCORDING to the *Matin*, one of the French military airships has recently succeeded in crossing the Mediterranean. The airship started from Paris, reached Aubagne, near Marseilles, and arrived at Algiers without incident, after a journey lasting eleven hours.

## German Aeroplane in Switzerland.

On the afternoon of December 4th, a new German

aeroplane, flying from Strassburg to Lorraine, lost its way, and, having been fired on, alighted in Switzerland, near the frontier. The occupants, two lieutenants of reserve, were arrested and taken to Basel.

## Dutch Seize German Seaplane.

THE two occupants of a German seaplane which was taken into Flushing, started from Ostend on the morning of Dec. 5th, and the machine falling into the sea on the same morning, they had been adrift 24 hours.

## Air Fight Over Swiss Territory.

AN aerial fight, in which several aeroplanes were engaged, took place between Müttentz and the Rhine, near Basel on the morning of December 6th. Two bombs fell in the vicinity of a school at Müttentz, breaking windows and doing other damage to the school building and some neighbouring houses.

At 2.30 a.m. the same day, near Meuziken, Canton of Aargau, four or five bombs from an aeroplane, the nationality of which was not ascertained, fell in a field, making a hole about 10 ft. deep.

## German Kite Balloon Adrift.

ON the night of December 5th, a large observation balloon, supposed to be German, was wrecked in the Kattegat, near Samsø Island. There were no persons on board.

## Zeppelins Out Again.

AFTER their disastrous visit to England some weeks ago the Zeppelins have not been in evidence in the North Sea, but the Stockholm correspondent of the *Morning Post* states that they have recommenced patrol work and are now travelling by night with lights, so that their movements can be easily followed. On the night of December 6th a Zeppelin, heading west, was observed off Ystad.



# The British Air Service

"PER ARDUA AD ASTRA"

**UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, it is not repeated in this column.**

## Royal Naval Air Service.

Admiralty, December 4th.

Warrant Officer, II (Temporary).—T. H. Sims, promoted to Lieut. (R.N.V.R.), seniority Oct. 9th.

V. F. R. Hill, granted temp. commn. as Sub-Lieut. (R.N.V.R.), seniority Dec. 10th.

Admiralty, December 5th.

Flight Sub-Lieutenants (Temporary).—K. Ogden, promoted to Flight Lieut. (temp.), seniority Nov. 17th; and W. E. N. Clark, granted temp. commn. as Sub-Lieut. (R.N.V.R.), with original seniority of May 16th.

Sub-Lieutenant, R.N.V.R. (Temporary).—W. A. Ross, promoted to Lieut. (temp.), seniority Nov. 12th.

J. Pearson entered as Sub-Lieut., R.N.V.R. (temp.), seniority Nov. 27th.

Admiralty, December 6th.

Wt. Teleg., R.N.R. (Temp.).—A. J. Gregson, entered as Wt. Officer, 2nd grade (temp.), seniority Dec. 5th.

B. R. A. H. Davies and R. M. Newman, both entered as Prob. Flight Officers (temp.), seniority Dec. 17th.

J. S. Harrison entered as Prob. Obs. Officer (temp.), seniority Dec. 4th.

J. H. Tindall granted temp. commission as Sub-Lieut. (R.N.V.R.), seniority Dec. 10th.

Admiralty, December 7th.

### Royal Naval Air Service.

The following have been entered as Prob. Flight Officers (temp.).—J. Marsden, G. K. Lucas, R. S. McCall, P. Girvin, H. R. F. Richardson, J. A. Simmers, R. L. Bonham, C. E. Sherlock, C. B. Smith, G. Todd, F. N. Aplin, M.C., P. B. Agur, J. P. Corkery, J. F. Fraser, R. E. W. Gwyther, H. J. Greenland, G. H. Grieve, and W. S. Haney.

Acting Gunner (R.N.).—W. Anderson, graded as Warrant Officer, 2nd Grade, seniority June 29th.

Admiralty, December 10th.

R. H. S. Calver entered as Prob. Observer Officer (temp.), seniority Sept. 9th.

C. E. Fox granted temp. commission as Lieut. (R.N.V.R.), seniority Nov. 28th.

## Royal Flying Corps (Military Wing).

London Gazette Supplement, December 4th.

The following appointments are made:—

Squadron Commander.—Temp. Capt. R. E. Saul, Gen. List, from a Flight Comdr., and to be Temp. Maj. whilst so employed; Nov. 21st.

Flight Commanders.—From Flying Officers, and to be Temp. Capts. whilst so employed:—2nd Lieut. (Temp. Lieut.) B. B. Toms, R. War. R., S.R.; Nov. 1st. Lieut. R. E. Angus, Yeo, (T.F.); Nov. 18th. Temp. Lieut. W. R. G. Pearson, Gen. List; Nov. 19th.

Flying Officers.—Temp. 2nd Lieut. L. C. F. Clutterbuck, Gen. List, from a Flying Officer (Obs.); Sept. 12th, seniority from Dec. 31st, 1916 (substituted for notification in Gazette of Oct. 29th). Capt. A. R. C. Morton, Canadian Exped. Force; Oct. 2nd (substituted for notification in Gazette of Oct. 26th). Temp. 2nd Lieut. (on prob.) E. Everatt, Gen. List, and to be confirmed in his rank; July 11th. Temp. Hon. 2nd Lieut. H. S. Malik, Gen. List; Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—W. G. Gunning, J. F. Bremner; July 13th. Lieut. J. C. Colling, Canadian Exped. Force; Oct. 29th. Temp. Lieut. T. Durrant, Gen. List, from a Flying Officer (Obs.); Oct. 31st, seniority from March 8th. Lieut. L. B. Aylen, S.R., from an Equipment Officer, 3rd Class; Nov. 6th. Temp. 2nd Lieut. (on prob.) A. Colquhoun, Gen. List, and to be confirmed in his rank; Nov. 10th. Lieut. B. A. Cooke, Canadian Exped. Force; Lieut. L. J. Sweeney, Canadian Exped. Force; 2nd Lieut. E. J. Dease, Rif. Brig., and to be secd.; Temp. 2nd Lieut. E. P. Critchley, Gen. List; Nov. 11th. Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—G. W. Bellin, J. O. Butler, C. R. White-lock, Maj. G. P. Howe, Canadian Exped. Force. Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—G. D. Batcup, J. W. S. Mellish, S.R., L. Poole, F. W. Chambers, G. H. Welsh, F. J. Davey, M. L. James, A. B. Taylor, H. R. Uttley, A. W. Franklyn, W. H. Kilbourne; Nov. 12th. A. C. McC. de Fleury; Nov. 13th. Temp. 2nd Lieut. A. Baillie, Gen. List, from a Flying Officer (Obs.), seniority from Oct. 6th, 1916; Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—A. P. Rapson; Nov. 14th. J. H. Dewhurst, R. McLaughlin; Nov. 15th.

Depôt Commander.—Temp. Maj. W. H. Lang, Gen. List, from a Park Comdr., and to be Temp. Lieut.-Col. whilst so employed; Aug. 31st.

General List.—F. C. Winby, late Temp. Lieut. A.P. Dept., to be Temp. Lieut.; Nov. 15th. To be Temp. 2nd Lieuts:—H. Y. Lewis; Oct. 13th. Cdt. (Flight-Sgt.) E. P. Critchley, from R.F.C.; No. 21st. To be Temp. 2nd Lieuts. (on prob.):—L. V. MacKenzie; Sept. 28th. L. Walsh, late Sgt., S. Air. Forces; Oct. 12th. H. J. Macready; Nov. 10th. Sgt. J. T. Lawlor, from Canadian Arms Inspn. Depôt; Nov. 16th. 2nd Class Air Mech. K. Fraser, from R.F.C.; Nov. 18th. H. H. Miller; Nov. 20th.

London Gazette Supplement, December 5th.

The following appointments are made:—

Flight Commanders.—From Flying Officers, and to be Temp. Capts. whilst so employed:—2nd Lieut. W. W. Rogers, S.R.; Nov. 18th. Temp. 2nd Lieut. A. H. C. A. Rawson, R. War. R.; Nov. 21st.

Flying Officers.—2nd Lieut. L. H. Jull, N. Staff. R., S.R.; Oct. 19th, seniority from May 5th (without pay prior to Oct. 19th). Temp. 2nd Lieut. (on prob.) F. C. Gilbert, Gen. List, and to be confirmed in his rank; Oct. 27th. Temp. 2nd Lieut. A. H. Fitzmaurice, Gen. List; Oct. 29th. Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—B. McPherson; Nov. 2nd. F. D. Lloyd, R. H. Speight, H. L. Le Roy; Nov. 6th. R. G. Mitchell, D. Kennedy, P. W. Birbeck; Nov. 7th. H. Townsend; Nov. 9th. The appointment of 2nd Lieut. H. G. Cox, R. Suss. R. (T.F.), notified in the Gazette of June 14th is antedated to Feb. 23rd. The surname of Temp. Lieut. W. A. Brown, North'd Fus., is as now described, and not "Bown," as in the Gazette of Nov. 19th.

Balloon Officers.—Temp. Lieut. D. Ive, R.A., Temp. 2nd Lieut. S. G. Brown, attd. Worc. R., and to be transf'd. to R.F.C. Gen. List; Nov. 13th.

Equipment Officers, 3rd Class.—Temp. 2nd Lieut. (on prob.) H. E. Tabor, Gen. List, and to be confirmed in his rank; Oct. 1st. Lieut. N. W. Wale, Ind. Army Res. of Off.; Oct. 15th. Temp. 2nd Lieut. (on prob.) F. W. G. Ticehurst, Gen. List, and to be confirmed in his rank; Nov. 1st. Temp. Lieut. C. H. Higson, Leic. R., and to be transf'd. to R.F.C. Gen. List; Nov. 16th. Temp. 2nd Lieut. (on prob.) E. Harrison, Gen. List, and to be confirmed in his rank; Nov. 17th. Temp. 2nd Lieut. E. A. Roberts, Devon. R., and to be transf'd. to

R.F.C. Gen. List; Nov. 18th. Temp. 2nd Lieut. (on prob.) W. F. Wallace, Gen. List, and to be confirmed in his rank; Nov. 22nd.

General List.—F. L. W. Dowling, late Temp. 2nd Lieut. R.W. Surr. R., to be Temp. 2nd Lieut., Nov. 16th. Cdt. L. W. Flynn to be Temp. 2nd Lieut. (on prob.); Sept. 22nd.

Cadets to be Temporary Second Lieutenants (on probation).—F. A. Allen, T. H. Ames, F. C. Arundel, E. H. Attwood, E. E. Armitage, R. A. Arnett, L. K. Baker, C. C. L. Baldwin, A. F. Batcheler, H. V. Barker, R. Beesley, R. H. Beaton, G. H. Beattie, J. A. Black, V. R. Blow, A. G. Blundell, E. H. Bishop, H. G. Browne, G. A. Boast, H. C. Bryant, G. J. Carroll, W. J. Cairns, W. H. Cox, L. Coleman, P. Collison, W. J. Cooper, C. Darbyshire, H. C. Dakin, F. A. N. Duk, A. G. Ely, E. H. Everitt, F. G. Edwards, A. O. Farmer, F. H. Fisher, C. K. Flower, G. P. Forbes, S. J. Furze, W. C. Francis, A. H. Freed, R. M. Grice, W. E. N. Growden, G. P. Giles, R. M. Gunney, J. Gannon, R. E. H. Goodhead, H. Hopkinson, R. C. S. Hall, J. N. Hamman, D. G. Higgins, A. N. Jones, J. W. Kelland, H. Kendall, B. W. King, A. W. Kilpatrick, C. S. Lammiman, C. E. A. Lappan, P. J. Livingstone, E. I. Levy, H. G. Lomborg, O. S. Lieberg, H. C. Lloyd, F. A. Lygo, H. C. Marr, S. R. Mantle, A. D. Markenzie, J. McDonald, H. S. McDowall, F. Meehao, R. W. Medcalf, J. J. Mordecai, D. Mumford, J. G. Millar, C. H. Miller, A. C. Morris, G. L. Nicholson, H. C. Noel, A. Nugent, D. A. Newton, C. H. Newton, T. T. Orde, L. B. Palmer, C. Parker, R. Pattison, H. G. Packford, W. R. Pearson, G. A. G. Porter, G. Richardson, A. T. Reid, J. F. Robb, J. M. L. Roots, R. S. Roberts, G. S. Rowley, C. B. Sanderson, A. L. Simpson, G. McG. G. Sloan, C. R. Selman, H. Seddon, A. K. Shuffelbotham, F. L. Shield, V. J. W. G. Shaw, J. P. Smith, W. V. Smith, J. O. Smith, W. H. Stone, W. L. Thomas, K. R. Thomas, H. C. Thomas, H. M. Towson, F. A. Taylor, W. G. Upton, F. A. Vaudeberg, E. K. Wallis, W. T. Warren, J. C. Watt, E. W. Watts, G. Watson, H. G. Walsh, E. E. Wilby, A. M. Wilson, C. S. Wingate, G. Wignall, R. J. F. Wells, W. E. Weeks, F. E. Wyeat, R. Wilcock, J. F. Young; Nov. 30th.

Memorandum.—The Right Hon. Sir J. A. Simon, K.C.V.O., to be Temp. Maj. Gen. List; Oct. 25th.

Lieut. (Temp. Capt.) G. de L. Wooldridge, R.F.C., S.R., to be Temp. Maj. while specially employed; Dec. 6th.

Supplementary to Regular Corps.—2nd Lieut. R. J. Lyster-Smythe to be Lieut.; July 1st.

London Gazette Supplement, December 6th.

The following appointments are made:—

Flight Commanders.—From Flying Officers.—Lieut. (Temp. Capt.) R. E. A. Dash, E. Surr. R. (T.F.), and to retain his temp. rank whilst so employed; and to be Temp. Capts. whilst so employed:—Temp. 2nd Lieut. O. E. J. McOustra, Gen. List; Nov. 20th; Lieut. F. R. K. Woodward, Lan. Fus., S.R.; Nov. 23rd.

Flying Officers.—Temp. 2nd Lieut. (on prob.) A. B. Bullock, Gen. List, and to be confirmed in his rank; Sept. 1st. Temp. 2nd Lieut. H. Y. Lewis, Gen. List; Oct. 13th.

Flying Officers (Observers).—Temp. 2nd Lieut. (on prob.) R. B. Sisson, Gen. List, and to be confirmed in rank; Nov. 16th, seniority June 26th; 2nd Lieut. F. H. Lear, R. War. R. (T.F.), seniority July 17th, and to be secd.; Temp. 2nd Lieut. (on prob.) A. W. D. Stackhouse, Gen. List, and to be confirmed in rank, seniority Aug. 22nd; 2nd Lieut. M. Walker, Glouc. R., S.R., seniority Sept. 23rd, and to be secd.; Nov. 13th. Lieut. J. P. Alexander, Canadian Exped. Force; Temp. 2nd Lieut. E. R. Bruce, Ches. R., and to be transf'd. to R.F.C. Gen. List; 2nd Lieut. W. E. Davis, Glouc. R., and to be secd.; Temp. 2nd Lieut. (on prob.) R. T. Shepherd, Gen. List, and to be confirmed in rank; Temp. 2nd Lieut. C. L. Shaw, R. Berks. R.; Temp. 2nd Lieut. H. Howard, attd. North'd Fus., and to be transf'd. to R.F.C. Gen. List; Temp. 2nd Lieut. J. A. Hoogterp, Labour Corps, and to be transf'd. to R.F.C. Gen. List; 2nd Lieut. H. A. G. Baker, Glouc. R. (T.F.), and to be secd.; Nov. 16th, seniority Sept. 24th.

General List.—Temp. 2nd Lieut. G. W. Barber resigns his commn.; Dec. 7th. To be Temp. 2nd Lieuts. (on prob.):—J. C. Wood; Oct. 13th; Temp. Sgt.-Maj. A. G. Knight, from R.F.C.; Nov. 15th.

Supplementary to Regular Corps.—2nd Lieut. (on prob.) A. V. McPhail is confirmed in his rank.

London Gazette Supplement, December 7th.

The following appointments are made:—

Flying Officers.—Temp. Lieut. W. B. Long, Gen. List, from a Flying Officer (Obs.); Nov. 15th, seniority from Sept. 1st. Lieut. H. D. Cunningham, Canadian Cav.; 2nd Lieut. A. W. Vigers, M.C., Signal Service, R.E. (T.F.), from a Flying Officer (Obs.), seniority Feb. 1st; Nov. 16th. Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their ranks:—D. R. Glen, E. B. Lee; Oct. 16th. H. Harker; Oct. 31st. R. H. Cowan, J. F. R. I. Perkins; Nov. 11th. A. L. T. Taylor, A. D. R. Jones; Nov. 15th. R. N. Maclean, J. K. Gaukrodger, C. T. Robinson, G. F. M. Apps; Nov. 16th. G. A. Lipsett, W. T. H. Shutt; Nov. 18th.

Flying Officers (Observers).—Temp. Lieut. D. S. Allison, Gen. List; Nov. 8th, seniority Oct. 11th. The date of seniority of Temp. 2nd Lieut. A. Watkinson, attd. E. York. R., is March 8th, and not as in Gazette of Oct. 9th.

Adjutant.—Temp. 2nd Lieut. (Temp. Lieut.) R. A. Pierpoint, Gen. List, from a Flying Officer, and to be Temp. Capt. (with pay and allowances as Lieut.) whilst so employed; Nov. 23rd.

Equipment Officers, 1st Class.—From the 2nd Class.—Lieut. C. G. Hetherington, S.R., and to be Temp. Capt. while so employed; Temp. Capt. H. L. Frich-ton, Gen. List; Nov. 16th. 2nd Lieut. (Temp. Lieut.) J. Rylands and to be Temp. Capt. whilst so employed; Nov. 21st.

2nd Class.—Temp. 2nd Lieut. F. J. Standerwick, Gen. List, from the 3rd Class, and to be Temp. Lieut. whilst so employed; Nov. 16th.

3rd Class.—Temp. 2nd Lieut. B. O. Angell, Gen. List, from a Flying Officer; July 22nd. Temp. Lieut. W. J. Cleasby, Gen. List; Sept. 12th. Capt. A. T. Cramer, Midd'x R. (T.F.), and to be secd.; Nov. 7th. Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—G. J. Briggs; Nov. 9th. J. C. Russell-Parsons, C. W. Triggs, J. T. Williams; Nov. 10th. 2nd Lieut. P. Rosie, Yeo, (T.F.), and to be secd.; Nov. 15th. Temp. 2nd Lieuts., Gen. List:—E. Lewis, E. M. Ling, G. J. H. Stein; Nov. 26th. The appointment of Temp. 2nd Lieut. W. B. Shelton, Gen. List, notified in Gazette of Sept. 8th, is cancelled.

General List.—Capt. (Temp. Lieut.-Col.) G. B. Hynes, D.S.O., R.A., a Depôt Comdr., to be Temp. Col. whilst specially employed; Dec. 1st. To be Temp. Lieuts.:—Sub-Lieut. W. J. Cleasby, from R.N.V.R.; Sept. 12th. Temp. 2nd Lieut. F. M. Macfarland; Sept. 27th. Sub-Lieut. D. S. Allison, from R.N.V.R.; Nov. 8th, seniority Oct. 11th. The following from R.F.C., to be Temp. 2nd Lieuts.:—Sergt. F. S. Ganter; Nov. 9th. Sergt.-Maj. E. Lewis, Sergt.-Maj. E. M. Ling, Flight-Sergt. G. J. H. Stein; Nov. 26th. To be Temp. 2nd Lieuts.

(on prob.)—H. D. Harrison; Sept. 12th. Cdt. M. G. Church, from R.F.C.; Oct. 3rd. M. C. S. Bowley, late Prob. Flight Officer, R.N.A.S.; Nov. 5th. D. R. Thomas; Nov. 17th. E. Haghe, J. A. McMullen, W. J. D. Partridge, R. W. L. Phillips, R. A. Silk, W. V. Wright; Nov. 19th. Sergt.-Maj. G. H. Blake, from S. Gds.; Nov. 21st. Temp. Sergt.-Maj. W. J. O. Newton, from R.F.C.; Nov. 22nd.

**Supplementary to Regular Corps.**—Lieut. (Temp. Capt.) N. H. Read relinquishes his commission and is granted hon. rank of Lieut.; Sept. 15th.

*London Gazette Supplement, December 7th.*  
**Royal Flying Corps (T.F.).**

**To be Second Lieutenants.**—Sergt.-Maj. G. A. Campbell, 2nd Class Air Mech. R. McKinnon Wood; Dec. 8th. Lieut. W. S. Senior to be Adj., vice Capt. H. P. Crosland, and is granted the acting rank of Capt., with the pay and allowances of a Lieut.; Oct. 9th. Capt. P. P. Miers is secd.; Nov. 24th. Lieut. H. J. Morley relinquishes his commission on account of ill-health contracted on active service, and is granted the hon. rank of Lieut.; Dec. 8th. 2nd Lieut. C. F. Mallett to be Lieut.; July 1st, with seniority next below Lieut. R. V. Hudson; Capt. A. R. Wood is secd. for duty, and is graded for purposes of pay as Staff Lieut., 2nd Class, whilst so employed; Oct. 2nd. 2nd Lieut. P. R. Smith to be Lieut.; Nov. 25th, and to remain secd.; Capt. A. H. Bowhill to be Adj., vice Capt. H. A. Campbell (Argyll and Suth'd Highrs); Oct. 19th. 2nd Lieut. D. P. McDonald to be Lieut., with seniority next below Lieut. C. D. Fother and to remain secd.; Nov. 9th. 2nd Lieut. J. Whamond, M.C., to be Lieut.; Nov. 19th. Sergt. S. M. Ogden to be 2nd Lieut.; Oct. 14th. C.S.M. W. H. Belton to be 2nd Lieut.; Oct. 14th. 2nd Lieut. L. Uprichard to be Lieut. with seniority next below Lieut. S. Dodd; July 1st. 2nd Lieut. C. D. Chapman to be Lieut., with seniority next below Lieut. R. G. Vines; July 18th, and to remain secd.; Lieut. H. C. Leir is restored to the estab.; Sept. 11th. Lieut. H. R. Ward (Hon. Capt. in Army) is secd.; Nov. 10th. Lieut. L. C. Vernon to be actg. Capt. whilst comdg. a Co. from Aug. 16th to Nov. 24th.

*London Gazette Supplement, December 8th.*

The following appointments are made:—

**Flight Commanders.**—From Flying Officers, and to be Temp. Capt. whilst so employed:—Temp. 2nd Lieut. (Temp. Lieut.) A. S. Lee, att'd. Notts. and Derby R.; Nov. 20th. Temp. 2nd Lieut. H. H. Maddocks, Gen. List; Nov. 24th.

**Flying Officers.**—Temp. 2nd Lieut. C. M. Hallet, Gen. List; Sept. 11th. Temp. 2nd Lieut. N. D. I. Gavin, K.O. Sco. Bord., and to be transd. to R.F.C., Gen. List; Sept. 18th. 2nd Lieut. G. C. Scarr, Ind. Army Res. of Off.; Sept. 19th. Temp. 2nd Lieut. F. H. Rowe, Oxi. and Bucks L.I., and to be transd. to R.F.C., Gen. List; Sept. 20th. Lieut. H. R. Mechan, R.F.A. (T.F.), and to be secd.; Sept. 22nd. Lieut. A. Dickson, R.F.A., S.R.; Temp. 2nd Lieut. A. Parrish, Gen. List, Sept. 25th. 2nd Lieut. A. Sutton-Jones, Devon R. (T.F.), and to be secd.; Sept. 29th. Temp. 2nd Lieut. J. A. Brandt, Gen. List; Sept. 30th. Lieut. S. G. Frogley, R. Berks R., S.R., from a Flying Off. (Obs.), seniority Oct. 31st, 1916, and to be secd.; Temp. 2nd Lieut. F. S. Ganter, Gen. List; Nov. 9th. Lieut. A. L. Johannson, Canadian Exped. Force; Lieut. (Temp. Capt.) P. K. C. Wright, A.S.C. (T.F.), and to be secd.; Nov. 15th. 2nd Lieut. (Temp. Lieut.) N. Mellor, W. Rid. R. (T.F.), from a Flying Off. (Obs.), seniority Dec. 9th, 1916. Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—R. J. Gosse; Sept. 26th. G. E. Race, C. E. Pither, H. V. Whitaker; Nov. 6th. A. E. Wylie, R. Renaham, M. E. Peiler; Nov. 12th. C. H. Williams, S. Caldwell, D. W. Dawson, N. S. Jones; Nov. 15th. A. G. Edwards, W. Legge, F. D. Nevins, W. Biheller, W. S. Eason, R. Scott, R. C. Crowden, C. L. Lindberg; Nov. 16th. A. D. Shannon; Nov. 17th.

**Assistant Instructor in Gunnery.**—(Graded as an Equipment Off., 3rd Class).—2nd Lieut. S. M. Campbell, Sco. Rif. (T.F.), and to be secd.; Sept. 1st.

**Balloon Commander.**—(Graded as a Balloon Officer).—Temp. 2nd Lieut. B. O. Butler, Gen. List, from a Balloon Off., and to be Temp. Lieut. whilst so employed; Nov. 4th.

**Equipment Officer, 3rd Class.**—Lieut. L. A. Sturrock, Ind. Army. Res. of Off.; Sept. 30th, seniority April 15th, 1916. Temp. 2nd Lieut. F. R. Davis, R.E., and to be transd. to R.F.C., Gen. List; Oct. 11th. Temp. 2nd Lieut. T. Thomson, att'd. Gord. Highrs., and to be transd. to R.F.C., Gen. List; 2nd Lieut. (on prob.) J. C. K. Hargreaves, S.R.; Nov. 15th. Temp. Lieut. G. R. Simms, R.A., and to be transd. to R.F.C., Gen. List; Nov. 17th.

**Experimental Officer, 3rd Class.**—(Graded as an Equipment Off., 3rd Class).—Lieut. C. G. Banister, Res. of Off.; Nov. 10th.

**General List.**—Temp. 2nd Lieut. P. G. Burnes resigns his commission; Dec. 9th. To be Temp. 2nd Lieuts. (on prob.):—J. W. Davis; Sept. 17th. K. Draco; Nov. 11th. W. C. Stribling; Nov. 14th. H. B. Shephard; Nov. 21st.

**Memorandum.**—Sergt. S. J. Clinch, from R.F.C., to be 2nd Lieut. whilst serving with R.F.C.; Nov. 18th.

*London Gazette Supplement, December 10th.*

The following appointments are made:—

**Flight Commanders.**—From Flying Officers, and to be Temp. Capt. whilst so employed:—2nd Lieut. H. J. Hamilton, D. of Corn. L.I.; Nov. 23rd. Temp. 2nd Lieut. B. J. Silly, Gen. List; Nov. 29th.

**Flying Officers.**—Temp. 2nd Lieuts. (on prob.), Gen. List, and to be confirmed in their rank:—L. S. Punnett, J. M. Purcell, J. A. Stewart, F. M. Ward; June 5th. A. Gerow; Sept. 24th. A. E. Rudge; Nov. 8th. J. T. Gibson, T. G. Kernick, G. M. Saunders; Nov. 16th. C. Bettinson, H. W. Auerbach, L. H. Brown, C. F. Muirhead, M. E. Draper, K. L. Boswell, E. O. Amm; Nov. 19th.

**Flying Officers (Observers).**—Lieut. E. R. Stranger, R.F.A. (T.F.), and to be secd.; Oct. 1st, seniority from July 1st. Temp. Lieut. D. M. Harper, Bord. R., and to be transd. to R.F.C. Gen. List; Oct. 2nd, seniority from July 5th. Temp. Lieut. L. C. Coward, Gen. List; Nov. 16th, seniority from Sept. 24th. Temp. 2nd Lieut. (on prob.) R. B. P. Wilson, Gen. List, and to be confirmed in his rank; Sept. 20th, seniority from June 27th. Capt. L. Laing, Dur. L.I. (T.F.), from Adj., A. Cyclist Corps, seniority from Sept. 10th. Temp. 2nd Lieut. (on prob.) L. M. Glover, Gen. List, seniority from Sept. 17th, and to be confirmed in his rank; Nov. 20th. Nov. 20th, seniority from Sept. 24th.—Temp. 2nd Lieut. A. Dutton, Gen. List; Temp. 2nd Lieut. (on prob.) W. R. McCoo, Gen. List, and to be confirmed in his rank; Temp. 2nd Lieut. (on prob.) G. G. Wilby, Gen. List, seniority from Sept. 25th, and to be confirmed in his rank; Lieut. A. de M. Severne, R.F.A. (T.A.), seniority from Oct. 3rd, and to be secd.; Nov. 20th.

**Balloon Officers.**—Lieut. R. M. Roberts, Canadian Exped. Force; 2nd Lieut. (Temp. Lieut.) C. Joiner, E. Surr. R., from a Flying Officer; Nov. 20th.

**General List.**—To be Temp. Lieuts.:—Temp. Sub-Lieut. L. C. Coward, from R.N.V.R.; Nov. 16th, seniority from Sept. 24th. H. V. Roe, late Lieut., Manch. R.; Dec. 8th. Temp. 2nd Lieut. D. T. Leysdon relinquishes his commission on account of ill-health contracted on active service, and is granted the hon. rank of 2nd Lieut.; Temp. 2nd Lieut. O. S. Wise relinquishes his commission on account of physical unsuitability as a pilot or observer. Dec. 11th. To be Temp. 2nd Lieuts. (on prob.):—T. H. Jones, late Prob. Flight Officer, R.N.A.S.; Nov. 16th. K. B. Voss, H. H. E. Wood; Nov. 26th. G. L. Chesterton, late Temp. 2nd Lieut., R.F.C., Gen. List, J. F. Richardson, late Capt., Linc. R., A. Wallas, late Sergt., Australian M.G. Corps; Dec. 11th. Cadets to be Temp. 2nd Lieuts. (on prob.):—J. A. Beard, J. R. C. Hamilton, C. Hopworth, W. H. Holton, K. E. Judd, G. L. McLean, F. W. Osman, W. V. Pegden, F. H. Reynolds, J. A. Shepherd, W. Thornton; Nov. 23rd.

**Memorandum.**—To be Temp. Lieut.-Col.—Lt. Lieut.-Col. W. D. Ingle, Middx. R., whilst commanding an R.F.C. Cadet Wing; Sept. 19th.

**Supplementary to Regular Corps.**—Capt. E. S. Skipper is placed on the retired list on account of ill-health; Dec. 11th.

**Aeronautical Inspection Department.**

*London Gazette Supplement, December 4th.*

A. D. Downie to be Temp. Hon. Lieut. whilst employed as Assist. Inspector A.I.D.; Aug. 1st.

*London Gazette Supplement, December 10th.*

B. H. Hogsden to be Temp. Hon. Lieut. whilst employed as Asst. Inspector A.I.D.; Sept. 1st.

**Royal Flying Corps (Territorial Force).**

*London Gazette Supplement, December 4th.*

**Royal Flying Corps (T.F.).**—To be Temp. Capt.:—Lieut. J. S. Irving, 2nd Lieut. (Temp. Lieut.) H. Medcalf, 2nd Lieut. (Temp. Lieut.) G. S. Wilkinson, 2nd Lieut. (Temp. Lieut.) J. H. Glover; Nov. 5th. 2nd Lieuts. to be Temp. Lieuts.:—W. J. Webber, T. G. Waterhouse; Nov. 15th.

*London Gazette Supplement, December 6th.*

A. Endicott to be 2nd Lieut.; Dec. 7th.

## QUESTIONS IN PARLIAMENT.

**Grants for Uniform.**

MR. BILLING on December 3rd, in the House of Commons, asked the Parliamentary Secretary to the Air Board whether it is proposed to make any uniform grant to the officers of the Air Service; and, if so, whether this grant will also be made to officers transferring from other services?

Major Baird: It is not yet possible to give information as to the terms of any grants for uniform which may be required in connection with the establishment of the new Air Service.

Mr. Billing asked the Parliamentary Secretary to the Air Board whether he is aware that the kit and equipment of a Service man does not wear out in its entirety simultaneously; whether having regard to the proposed introduction of the new uniform for the Air Service as and when old uniforms are worn out, he will say if this applies to the wearing out of separate garments; and, if not, is he aware that if separate garments are requisitioned and supplied as required, the entire uniform of the men who are being transferred will never be worn out?

Major Baird: I do not think that matters of administrative detail such as those referred to lend themselves to discussion by means of question and answer. The hon. member may rest assured that arrangements will be made to effect the change of uniform in the Air Force without bringing about the results contemplated in his question.

**Advisory Committee for Aeronautics.**

MR. BILLING, in the House of Commons on December 4th, asked the Prime Minister if he has received a Report as to the progress and recommendations, if any, of the Advisory Committee for Aeronautics; if he will say how many sittings this Committee has held within the last six months; whether any changes have been made in its personnel during this period; what is the annual cost to the State of this Committee, including salaries, rent, rates, taxes, printing, posting, and stationery; and whether this Committee is to be continued?

Colonel Craig (Treasurer of the Household): A Report on the work of the Advisory Committee for Aeronautics was submitted to the Prime Minister in June last. Communications from the members of the Committee and reports on the experiments and researches carried out under the control of the Committee are submitted month by month to the Technical Department of the Air Board. Eighty-eight such communications have been submitted during the past six months, during which six meetings of the Committee have been held and thirty meetings of sub-committees appointed to deal with special branches of the work. No change in the personnel of the Committee has been made during this period. The cost of the Committee for the financial year 1916-17, including the salaries of the secretarial and clerical staff and of posting, was £1,752 1s. 3d. This does not include printing and stationery, for which separate figures are not available. The Committee meet at the Air Board, and incur no direct expenditure in respect of rent, rates, and taxes. The answer to the last part of the question is in the affirmative.

Mr. Billing: How many of the eighty-nine recommendations have been adopted?

Colonel Craig: Perhaps the hon. Member will kindly address that question to my hon. and gallant friend when he comes back.

**Air Raid Warnings.**

MR. GILBERT, on December 5th, asked the Home Secretary whether his attention has been drawn to the action of several London borough councils of exhibiting coloured lights in their districts on air-raid nights; and will he issue an Order to standardise these lights, so that the same colours shall be shown all over London both for warnings and all-clear purposes?

Sir G. Cave: I am aware that several borough councils have adopted this device. The Commissioner of Police has arranged that any local authority may supplement the police warning to "take cover" by exhibiting a suitable red light and the "all clear" by a green or white light.

**Air Ministry.**

MR. W. THORNE, on December 6th, asked the First Commissioner of Works whether the Air Minister is taking over the Metropolitan Water Board offices at the Savoy Hotel; if he is aware that one part of the hotel is not occupied by the Metropolitan Water Board; if he will consider the advisability of taking over the Hotel Ritz instead of removing the Metropolitan Water Board from the present offices; and if he will take action in the matter?

The First Commissioner of Works (Sir Alfred Mond): The answer to the first two questions is in the affirmative. As it is absolutely essential that the branch of the Air Board for which this accommodation is required shall be in close proximity to the headquarters of the Board, I can see no useful purpose in considering the commandeering of the Ritz Hotel.

Mr. Watt: Can the right hon. gentleman promise any finality to this absorption of hotels?

Sir A. Mond: No.

Mr. Pringle: How many of them are not being used?

Sir A. Mond: I do not know of any which are not being used.

**Air Force (Transfers).**

COLONEL F. HALL asked the First Lord of the Admiralty whether, under the Air Forces Bill, the time previously served in the Army or Navy by officers or men transferred to the Air Force is to be added to the time served in the latter Service for the purpose of calculating pension provision; whether in the case of similar transfers between the Army and Navy the time served previous to transfer, unless discharge is due to invaliding, only counts for pension subject to certain conditions and with a limit of time; if he will state the nature of such conditions



and if he will say what grounds exist for a difference of treatment in the case of the Army and Navy as compared with the Air Force?

Dr. Macnamara: The position of officers in this matter is now under consideration between the Admiralty and the Air Board. As regards men, the answer to the first and second parts of the question is in the affirmative. As regards the third part of the question, the maximum time allowed to count for pension purposes when ex-Army men join the Navy or *vice-versa*, in circumstances other than those of invaliding from their earlier Service, is four years, and this is subject to the following conditions: that no time is allowed for which the man received an assessment of character inferior to "fair"; that a break of five years did not elapse between the two Services; that the former service is acknowledged on entering the sister Service. Here the principle followed is that when it is necessary in the interests of the State to transfer men from one Service to another, their full pension rights should be preserved; but when a man by his own choice elects to join the sister Service instead of re-entering the Service to which he previously belonged, the limitations I have given are imposed, because obviously his service is not immediately so valuable as it would be if he had rejoined his old Service.

Colonel Hall: Is there any reasonable cause why men transferred from the Navy to the Air Force should have better conditions than men transferred from the Navy to the Army?



## AIRCRAFT WORK AT THE FRONT.

### OFFICIAL INFORMATION.

#### British.

*War Office, December 4th.*  
"Our aeroplanes continue to bomb the Turkish communications in the vicinity of Tul-Keram with successful results."

*General Headquarters, December 4th.*  
"On the 3rd inst. a great deal of reconnaissance, artillery, and photographic work was carried out by our aeroplanes. Villages in the occupation of the enemy on the Cambrai battle front were attacked with bombs and machine-gun fire from the air, and our aeroplanes also co-operated with our infantry in the local fighting east of Ypres. During the night 291 bombs were dropped by us on villages west of Cambrai, some of the pilots engaged on this work making as many as three consecutive trips. In air fighting two hostile machines were driven down out of control. Two of our aeroplanes are missing."

*War Office, December 5th.*  
"*Salonica.*—During the past week our aeroplanes have shown very great activity. The aerodromes at Hudova (in the Vardar Valley, east of Strumnitza Station) and Drama, the railway stations at Drama and Porna, and numerous dumps and encampments have been successfully bombed. Two hostile machines have been driven down out of control."

*General Headquarters, December 5th.*  
"On the 4th inst., although the weather was fine, a dense haze over the line greatly interfered with work in the air. Reconnaissance work was carried out by our aeroplanes throughout the day, and 118 bombs were dropped on an enemy aerodrome north of Douai and on villages and German machine-gun emplacements in the battle area. Several thousand rounds were fired at the enemy's troops in their trenches and in the open. Only one or two fights took place in the air, and no decisive results were obtained. None of our machines are missing."

"On the afternoon of the 5th inst. two raids were carried out by our aeroplanes into Germany. These are the first that have been possible for over a month owing to incessant bad weather. One raid was carried out on the large railway junction and sidings at Zweibrücken (17 miles east of Saarbrücken) and the other on the works of Saarbrücken. Many direct hits were observed in both cases, and two large fires were started. Hostile anti-aircraft gunfire was heavy and accurate, but all our machines returned safely."

*Admiralty, December 6th.*  
"On December 5th naval aircraft carried out a bombing raid on Sparappelhoek aerodrome. Many bombs were dropped on objective and also on a train leaving Engel dump. Numerous engagements with enemy aircraft have taken place during patrols, with the result that three hostile machines have been destroyed and one driven down out of control. During December 4th also, in the course of our patrols, three enemy aircraft were shot down out of control. All our machines have returned safely."

*War Office, December 6th.*  
"*Palestine.*—On December 4th one of our aeroplanes attacked two hostile reconnoitring machines escorted by four scouts; one enemy machine was driven down out of control, the remainder fled."

*General Headquarters, December 6th.*  
"On the 5th inst. there was great activity in the air on both sides. Our aeroplanes carried out a great deal of work with our artillery, as well as several long-distance reconnaissances, and took many photographs of the enemy's back areas. By day, bombs were dropped and many rounds fired from machine-guns on various ground targets. During the night of the 5th-6th inst., Gontrode aerodrome was successfully bombed, and two direct hits were obtained with heavy bombs on the enemy's aeroplane sheds. Other bombs burst among buildings around the aerodrome. In addition, bombs were also dropped on St. Denis Westrem aerodrome and Douai railway station. Fighting took place yesterday throughout the day. Four hostile machines were brought down and five others driven down out of control. One German machine was shot down in our lines by anti-aircraft gunfire. Five of our aeroplanes are missing."

"To-day, another successful raid was carried out by our aeroplanes into Germany. All our machines returned safely, but no further details have yet been received."

*General Headquarters, December 7th.*  
"On the 6th inst. the weather was again good and enabled our aeroplanes to continue reconnaissance and photographic work over the enemy's positions, lines of communications, and aerodromes. Hostile billets were bombed throughout the day, and a particularly successful raid was carried out against Valenciennes railway station and sidings, where fires were started. In addition, every opportunity was taken of engaging the enemy's infantry in their trenches with machine-gun fire. A great deal of fighting took place, in which five hostile machines were brought down and three others driven down out of control. One of our aeroplanes is missing."

*Admiralty, December 7th.*  
"During December 5th and 6th bombing raids were carried out by naval aircraft on the following objectives:—Uytkerke aerodrome, St. Denis Westrem aerodrome, Engel aerodrome, Bruges dock, and various railway traffic. Bombs were observed to explode, and fire was caused amongst huts and sheds. All machines returned safely."

"In the course of the usual fighting patrols two enemy aircraft were destroyed; four more were shot down completely out of control, three of which were probably destroyed."

*General Headquarters, December 8th.*  
"On the 7th inst. low clouds and bad visibility made conditions less favourable for flying. Our aeroplanes observed for our artillery and carried out several low reconnaissances and the usual bombing raids. Hostile troops in their trenches were again engaged with machine-gun fire. Very little fighting took

place. One German machine was brought down and another landed intact behind our lines. Four of our aeroplanes are missing."

#### Compensation for Air Raid Damage.

COMMANDER NORMAN CRAIG asked the Chancellor of the Exchequer upon what principle the date as from which the Government will grant relief or assistance in case of loss or injury by enemy action was fixed; and why the victims of such action in the earlier stages of the war, when the necessity for insurance was less fully recognised and the means of effecting insurance was less fully available, are excluded from benefit?

Mr. Bonar Law: It is essential in connection with the administration of any scheme giving a general right to claim compensation that the property damaged should be inspected at the earliest possible moment, and it was considered that September 1st last was the earliest date from which the scheme now in operation could safely be made retrospective. The Government are, therefore, not prepared to antedate that scheme still further; but, as I stated in reply to the hon. member for West Carmarthenshire on the 3rd inst., they have under consideration proposals which will enable grants to be made in cases in which persons of comparatively small means are suffering substantial hardship irrespective of any question as to the date when the damage was done.

place. One German machine was brought down and another landed intact behind our lines. Four of our aeroplanes are missing."

*General Headquarters, December 9th.*  
"On the 8th inst. rain prevented flying until the afternoon, when a certain amount of artillery work and reconnoitring was done. Bombs were dropped by our aeroplanes on hostile billets and many rounds were fired from the air at ground targets. Two of our aeroplanes are missing."

*Admiralty, December 9th.*  
"During the forenoon of December 8th naval aircraft carried out a bombing raid on Aertrycke aerodrome. The weather conditions were cloudy, but many bombs were dropped on objective. The bombers were attacked by enemy aircraft scouts, two of which were driven down completely out of control and appeared to be damaged. Many fighter patrols have been carried out, during the course of which two hostile machines were destroyed and one shot down completely out of control. All our machines have returned safely."

#### French.

*Paris, December 4th.*  
"During Sunday two German aeroplanes were brought down by our pilots. Three other enemy machines fell into our lines."

*Paris, December 5th.*  
"Enemy aeroplanes bombed last night the region north of Nancy. Three persons were wounded. During the day of December 3rd two German aeroplanes were brought down by our pilots. Six other machines were forced to land in their own lines."

"Last night Dunkirk was bombarded by enemy aeroplanes. Two persons among the civil population were killed."

*Paris, December 6th.*  
"During the day of the 5th our aviation service was very active. Three German aeroplanes were brought down and eight other machines badly hit in fighting with our pilots fell in their own lines."

"Our bombing aeroplanes carried out different operations. Nine thousand kilos (about 9 tons) of projectiles were dropped, especially on the railway stations and depots of Lichtervelde and Cortemarck, on the cantonments and bivouacs in the region of Laon, and on the depots of Roussach, &c."

"Some German aeroplanes dropped bombs during the night of the 6th in the region of Dunkirk. There were several casualties. Calais was also bombarded during the same night. No casualties were reported."

*Paris, December 7th.*  
"During the night of December 5th-6th our airmen bombarded the railway stations of Freiburg and Thionville and various enemy depots and cantonments behind the front."

*Paris, December 8th.*  
"During the bombardment of Calais by German aeroplanes during the night of December 5th-6th seven persons were killed and about 20 injured."

#### Italian.

*Rome, December 4th.*  
"Two enemy captive balloons were brought down."

*Rome, December 7th.*  
"On the afternoon of the 5th two enemy aeroplanes, one of them in an aerial combat, were brought down by our French Allies."

*Rome, December 8th.*  
"Between Asiago and the head of the Frenzela Valley noticea (sic) movements and assembling of enemy troops, which always kept out of rifle range, were shelled for a long time by the concentrated fire of our batteries, and they also served as objectives for big bombardment action carried out by our and our Allies' air squadrons. Altogether 150 machines dropped bombs on the enemy's lines, causing damage, losses, and explosions of ammunition dumps. The valiant airmen, then flying low, attacked the enemy troops with machine gun fire."

"Last night our airships in the neighbourhood of Quero and Motta di Livenza bombarded with several tons of bombs enemy bivouacs and motor-lorry columns in movement. In air duels three enemy machines were brought down during the day. Major Baracca gained his 30th victory."

*Rome, December 9th.*  
"On the Piave Plain at San Dona Valley artillery activity on both sides was very noticeable. Numerous enemy patrols were repulsed with rifle fire."

"Our Caproni machines effectively bombarded the enemy's lines of communication on the Asiago Plateau, afterwards firing with machine-guns on the troops leaving the places bombed. During last night the airships repeated their daring raids, dropping more than 4 tons of bombs on enemy encampments near Quero, Motta di Livenza, and Portogruaro. Two enemy aeroplanes were brought down and a captive balloon on fire fell in the neighbourhood of Grisolera."

*Rome, December 10th.*  
"An enemy aeroplane was brought down by a French airman."

*German.*  
"Yesterday 18 enemy aeroplanes were brought down in aerial fighting and by gunfire from the ground."

*Berlin, December 7th.*  
"Lieutenant Müller obtained his 36th victory in the air."

*Berlin, December 8th.*  
"Lieutenant Müller has obtained his 37th aerial victory."

*Austrian.*  
"Our airmen yesterday fought numerous aerial battles and shot down six Italian aeroplanes. The "deputy" officer Arrighi gained his 21st aerial victory."

*Turkish.*  
"Turkish aeroplanes and seaplanes have dropped bombs on Imbros."

*Constantinople, December 6th.*

## SIDE-WINDS.

THEIR registered offices at Caxton House having been commandeered, Messrs. Robert Ingham, Clark and Co., Ltd., have had to seek quarters elsewhere and are now installed at Walter House, Bedford Street, Strand, W.C., where all communications should be addressed in future. The telegraphic address is "Pearline, Westrand, London," and the telephone call Regent 3923.

IN their efforts to do everything possible to ensure that the workmanship of their products is of the very best, Whitehead Aircraft, Ltd., have had posted in their various shops that very telling sentence, "A hidden fault may cause a brave man to lose his life." The words are printed in red, and the cards should serve as a reminder—if that is necessary—of the supreme importance of their work.

OUR readers will remember that in FLIGHT of a fortnight ago appeared a couple of photographs of a hydro-aeroplane, the feature of which was the use of a couple of Ford motors. It was our purpose to accompany the photos with a paragraph giving a few details with regard to the machine. When going to Press, however, the paragraph, which had been written and sent to the compositors, had completely disappeared and a search failed to reveal any trace of it. Other arrangements were made, and little more was thought of the matter. The second phase of the incident was entered upon last week, when Mr. Edward G. Brown, 5, 6 and 7, Great Hampton Street, Birmingham—who is fortunate enough to be able to supply those excellent Palladium commercial vehicles—asking why we had inserted some additional matter in his advertisement. On investigating the matter, lo and behold it was found that the paragraph which had so mysteriously disappeared the previous week had turned up. How and why the paragraph transferred itself from the editorial to the advertisement pages is a mystery which so far we have been unable to fathom. Anyway, we apologise to Mr. E. G. Brown for the liberty which was taken with his advertisement.

ONE of the most popular and telling speakers who used the Tank Bank as a platform in Trafalgar Square last week in connection with the National War Savings Committee campaign was Sir Charles Wakefield. Putting in a plea for food economy, Sir Charles said, "We all eat too much, both for health and pocket. When busy in the City I frequently content myself with three glasses of hot water for luncheon, and have found it an excellent lubricant." This observation appealed to an Irish hearer's sense of humour, and a voice with a rich brogue called out from the crowd "How much whiskey do you put with it?" Sir Charles' reply was apt. "None, my friend, whiskey is too dear?" Sir Charles concluded by stating that he would give 200 £1 War Savings Certificates to the wounded Tommies among the crowd as a Christmas Box. The news spread round, however, and it was found that the number who gathered exceeded 200, and immediately Sir Charles procured another 50 to the entire satisfaction of the wounded men, who accorded him hearty cheers. Before leaving the Square Sir Charles himself purchased £5,000 worth of War Bonds.

"LACTOCOL" is a new cold glue which is being placed on the market, and the makers are so confident of its quality that they give with it a guarantee to stand a stress of 1,300 lbs. per sq. in. The Lactocol Co. is well equipped with up-to-date laboratories, and has a staff of chemists engaged in research work in the endeavour to still further improve their product, the use of which is, we understand, approved by the A.I.D. Further, every parcel of glue, they inform us, is thoroughly tested before being despatched. Samples will be gladly supplied to any firms interested if they will apply to the works at Studley Road, Clapham, S.W. 4.

It is pleasing to hear from Mr. Fred Norman, the managing director of the National Aircraft Co., Ltd., of Hackney Road, who, as the pages of the early volumes of "FLIGHT" bear witness, was one of the pioneers of the industry, that the Company has found it necessary to acquire additional works. Commodious premises have been secured, and are now in process of alteration to adapt them to their new use. This is a good sign and we hope to be able to chronicle further extensions of this firm's activities before long.

### The U.S. Standard Aeroplane.

THE first flight of the standard American military aeroplane with a machine-made Liberty motor taken from the stocks, was made on Thanksgiving Day, says the Times Washington correspondent. As a special compliment a British officer was taken up as observer. He declared himself absolutely satisfied with the results from every point of view.

## COMPANY MATTERS.

### Shell Transport.

THE directors of the Shell Transport and Trading Co., Ltd., have declared a dividend of 2s. per share, tax free, on the ordinary shares, payable 5th January.

### Palmer Tyre.

THE report of the Palmer Tyre, Ltd., for the year ended September 30th last states that the profit amounts to £11,421, which added to £1,001 brought forward makes available a total of £12,422. The directors recommend a dividend, free of income tax, at the rate of 12½ per cent. per annum, to place £3,000 in reserve, and to carry forward (subject to payment of directors' fees) £1,922. Meeting, 106, Cannon-street, E.C., 20th instant, noon.

### NEW COMPANIES REGISTERED.

ALPHAERO ENGINES, LTD., 57, Gracechurch Street, E.C.—Capital £21,500, in £1 shares. Engineers, manufacturers of and dealers in aircraft, of internal combustion engines, &c.

ASHFORD AIRCRAFT WORKS, LTD., Cree House, Gracechurch Lane, E.C. 3.—Capital £10,000, in 9,750 preference shares of £1 each and 5,000 ordinary shares of 1s. each. First directors: G. Macris, J. Fenston and G. Florence.

BIRCH AIRCRAFT MANUFACTURING CO., LTD., 169-71, High Road, Willesden Green, N.W.—Capital £2,000, in £1 shares (1,000 10 per cent. cumulative preference). Managing director: J. Birch.

G. HEWSON, LTD., 191, Bishopsgate, E.C. 2.—Capital £5,000, in £1 shares (4,000 5 per cent. cumulative preference). Carriers, railway and forwarding agents, aeroplane and ship-owners, &c. First directors: H. Durell, H. H. Durell and G. B. Durell.

J. JACKSON, LTD., Bramley, near Guildford, Surrey.—Capital £10,000, in £1 shares (5,000 preference). Acquiring business carried on at Bramley, Surrey, as J. Jackson, iron-founders, mechanical and motor engineers, manufacturers of and dealers in aircraft and parts thereof, &c. First directors: W. D. Warren and J. H. Warren.

### BUSINESS NAMES REGISTRATIONS.

DIXONS.—Registered November 2nd, 1917. Aeronautical engineer. 245, Putney Bridge Road, Putney, S.W. 15. Proprietor: E. Dixon (British), 91, Cowick Road, Tooting, S.W. 17. Business commenced October 21st, 1917.

NEW RIGID AIRSHIP CO., 39, Victoria Street, Westminster, S.W.—Registered October 29th, 1917. Aircraft designers and contractors. Proprietor: James J. Mayrow (Russian), 30, Lambert Road, Brixton Hill, S.W. Business commenced October 1st, 1917.

### Aeronautical Patents Published.

Applied for in 1916.

The numbers in brackets are those under which the Specifications will be printed and abridged, &c.

Published December 13th, 1917.

- 13,547. A. H. WILKS and P. H. HARTSHORNE. I.C. engines for aeroplanes. (111,124).  
14,955. T. D. KELLY. Planes for aeronautical machines. (111,128).  
17,092. H. T. WILLIAMS. Machine for erecting or assembling wings of aeroplanes. (111,178).

If you require anything pertaining to aviation, study "FLIGHT'S" Buyers' Guide and Trade Directory, which appears in our advertisement pages each week (see pages xlii, xlv and xlv).

## FLIGHT

and The Aircraft Engineer.

36, GREAT QUEEN STREET, KINGSWAY, W.C. 2.

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Telephone: Gerrard 1828.

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